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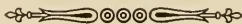
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BLAZING THE TRAIL

THE leading article for the next number of *NATURAL HISTORY* is an account by F. Trubee Davison, President of the American Museum, of his recent expedition to Africa. The dominating exhibit to appear in the Akeley African Hall at the American Museum will be a herd of elephants, placed in the center of the hall and surrounded by habitat groups of other African animals. Four of these elephants are already mounted, while the others, obtained by Mr. Davison, will be added as soon as the great task of preparing them for exhibit can be completed. The finished group will undoubtedly be one of the most impressive presentations of the kind ever attempted by any museum. It was primarily to complete the collection of specimens for this group that Mr. Davison went to Africa, and his article is a highly interesting account of present-day field work for a great museum.

MORE and more are the early American civilizations attracting the attention of informed readers, but as yet the literature on the subject, so far as the lay reader is concerned, has left great gaps that still remain to be filled. Beginning with its next number, *NATURAL HISTORY* will publish a series of articles on the art of pre-Columbian Central America, in which all the major artistic accomplishments of the native civilizations will be included. Dr. George C. Vaillant is the author of this series which, when completed, will be published in book form. The first article will be on Central American architecture, while later articles will cover jewelry, sculpture, costumes, painting, and pottery.

THOSE of us who occasionally go down to the sea in ships are not likely to imagine that the American Museum would have anything to do with the erection of the pier from which we go

aboard ship. Nevertheless, when the city of New York decided to build three gigantic new piers for the accommodation of new and greater transatlantic liners, Dr. Chester A. Reeds, the American Museum's curator of geology, was called upon to help in solving some of the problems that were faced. For the next number of *NATURAL HISTORY*, Doctor Reeds has written an article in

which he tells of these huge, new piers, and the difficulties that arose in their construction.

AT the time this magazine goes to press, the editors are in communication with Mr. Zane Grey, and hope that as a result it will be possible to publish an article by this widely known author and fisherman. Mr. Grey has spent several seasons fishing in New Zealand waters, and has become acquainted with the mako, a shark which appeals to Mr. Grey as a sporting fish of unusual merit. It is an article on this fish, and Mr. Grey's experiences in fishing for it, that we hope will appear in the next number of *NATURAL HISTORY*.

WILLIAM H. CARR has written, for the next number, an account of the fawns that during

last year have been living at the Bear Mountain Nature Trail. Both the article and the photographs that accompany it will give our readers a new appreciation of these gentle and trusting little animals.

MR. H. C. RAVEN has spent more than a little time among the natives of the Celebes, Borneo, and other islands of the East Indies. As a result he knows these distant peoples well, and he has written an article about them for the March-April issue of *NATURAL HISTORY*—an article on how they live, and especially on how and what they eat. There will be other articles, but lack of space precludes their mention.

THE COVER PAINTING

"FENCE LIZARDS," the cover painting of this issue by Francis L. Jaques, staff artist, represents a scene in the life of the most abundant lizard of the New Jersey pine barrens. The significance of the brilliant blue stripe in the social life of this local reptile was not fully understood until experiments with artificially colored individuals were carried out in the field. Doctor Noble in his article describes this field work and discusses its bearing on the general problem of sexual selection as propounded by Darwin. The two lizards in the foreground are males disputing the ownership of a particular log pile. The original owner of the pile has compressed his body, and rising high on his toes discloses his brilliant lower surfaces as a warning to the other male to keep away. The lizard descending a tree in the background is a female whose attention is attracted by the squabble.



In sprightly accord with the modernistic *motif* in decoration are novelties of zebra skin designed and executed by the Studios. Ladies' cigarette-cases and handbags, book-ends, photograph albums and picture-frames are among these. The distinguished cigarette or jewelry box pictured above is made of a zebra face.

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NUMBER 1

NATURAL HISTORY

JAN.—FEB.
1934

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor



A. KATHERINE BERGER
Associate Editor

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READY FOR A TIGER DRIVE

Most impressive of all hunting parties is one bent on beating for tigers. Equipped with many elephants, each one thoroughly trained for the part it has to play, and hunting a powerful animal through grass so tall that sometimes this rises above the backs of the elephants, such sport is both dramatic and unique

(See "A Tiger Hunt in Nepal," Page 45)

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JANUARY-FEBRUARY, 1934



EXPERIMENTING WITH THE COURTSHIP OF LIZARDS

Field Studies on the Social Relations Among the Fence Lizards of the
New Jersey Pine Barrens

BY G. KINGSLEY NOBLE

Curator of Experimental Biology, American Museum

MUCH of the beauty which we see in the animal world was attributed by Darwin to female choice, or sexual selection as he called it. In many fishes, reptiles, birds, and other forms of life, the male is gaudily colored and adorned; while the female is comparatively inconspicuous. Darwin thought that this glorification of the male was the direct result of the female's choosing—over a great many generations—the most attractive suitors for mates.

Although Darwin's theory has been before naturalists since 1871, very little evidence has been presented to prove or disprove it. One reason for this is that the attention of zoölogists has been largely directed not toward the functional significance of color but toward the genetics of color inheritance or toward the hormones, the "chemical messengers" of the blood which elaborate these tones. Another, and perhaps more important, reason for the present uncertain status of this theory is the difficulty of the problem itself. Conclusions obtained from a study of captive material ought to be checked in the field; and the problem of performing

critical experiments with unrestrained individuals in nature is very great.

In the laboratories of experimental biology at the American Museum there has been maintained for several years a colony of lizards employed in a variety of physiological studies. Among these lizards it was observed that the males endowed with handsome liveries displayed these adornments to good effect not to attract females but to intimidate rival males. Sex recognition was dependent upon the degree of display of color on the approach of an aggressive male. These conclusions differed so widely from the views of Darwin and of the majority of naturalists who have more recently observed reptiles in the field, that it seemed desirable to re-study the whole problem under natural conditions.

Fortunately at this moment the United Clay Mines Corporation, through its vice-president, Mr. C. W. Hall, generously offered to help these field studies by placing at our disposal a house in the little settlement of Crossley in the heart of the New Jersey pine barrens. Near Crossley we knew the fence lizard, *Sceloporus*



ON THE EDGE OF LIZARD COUNTRY

Lakehurst, known as the home port of dirigibles, is also a center for cranberry bogs, rare frogs, and fence lizards



QUI VIVE

When the spring sun shines, the male fence lizard mounts guard over his domain of fallen logs and sandy wastes



ISOLATED

On Breakneck Ridge, overlooking the Hudson River opposite Storm King Highway, a colony of fence lizards flourishes in spite of the bleakness of the terrain



THE TRESPASSER

From afar the male recognizes this trespasser as a possible mate. How can he distinguish between the sexes so quickly?



A FISHERMAN OF THE AIR

While workers studied nature problems beneath the pines, ospreys flew back and forth to their nests above

undulatus, was abundant. The male of this species bears on each side of his body a handsome stripe of blue which is nearly continuous with a spot of the same color on the throat. The display of this species as observed in the laboratory is as well marked as that of any American lizard and, with a field laboratory available, a close study of its behavior could be made throughout the year.

The fence lizard is common throughout the pine barrens of eastern United States but oddly enough occurs also in some numbers on Breakneck Ridge and a few other rugged mountains along the Hudson. These two habitats have little in common other than a certain bareness. Still it is difficult to believe that this has been the controlling factor in the distribution of the species. There are many animals and plants that are never found outside the pine barrens,¹ but the physiological factors



COURTSHIP UNDER CONTROL

A female fence lizard attached to a thread is maneuvered into a position beside a male. The latter in his excitement allows the observers to move closer without his taking fright

which bind them to these desolate stretches are not well known.

Sunlight, which may be intense in regions of scanty vegetation, plays an important rôle in the daily activities of the fence lizard. Messrs. W. G. Hassler and G. C. Lipsey went in the middle of March to the field station at Crossley and found that some males had already come out from hibernation along a protected bank skirting a cedar swamp. These males were in exposed positions where the sun fell directly upon their backs. The heat was not enough to warm their bodies thoroughly, for they were extremely lethargic and could be caught easily by hand. Not until March 27 did we find these lizards taking the slightest interest in one another. Then a mild chase was observed between two of them. The first females did not appear until April 2. One was seen eighteen



MAN'S HANDIWORK IN THE AIR

Airships, sailing overhead to their home berths near by, often invaded the quiet of the pine barrens



TAGGED

To follow the movements of individual lizards, an aluminum skin clip bearing a number is attached behind the ear of each animal, permitting certain identification on all later meetings



BEGINNING THE BLUFF

On spotting a rival, a male lizard compresses his body, bringing his brilliant blue lateral stripe into full view as a warning to keep away

inches from a male without arousing any interest in him. Such early spring indifference stands in striking contrast to the behavior of birds who are endowed with mechanisms for making their own blood warm and hence are not dependent on the sun.

We were interested in following the movements of individual lizards throughout the year. Each lizard which we found we tagged with a small aluminum skin clip bearing a number. In order to identify each lizard at a distance we placed one or more spots or narrow bands of bright yellow or red paint on some exposed part of the body. We knew that this paint would be lost at the first molt, but we hoped that this event would not occur until after courtship. One might assume that a lizard released in the pine barrens with the infinite possibilities of concealment would never be seen again. But of the 226 lizards tagged from March

to June, 155 were seen on another occasion and a large number many times.

As the season advanced it was clear that the lizards did not move aimlessly through the barrens, but each individual tended to have a particular territory. For example, one male which we first saw on March 17 was observed on ten different days patrolling an area approximately 120 feet on either side of his home log. A female first appeared on the periphery of this range on April 13 and we recorded her movements on four different days. Until May 15, when mating occurred, the female was always found within thirty feet of the center of her territory. During more than a month she had apparently not stirred herself to move nearer the center of the male's range of activity.

If the two sexes remained indefinitely in discrete territories there could be little courtship. We were therefore interested

ANOTHER KIND OF BLUFF

In striking contrast to the tactics of the lizard, the hog-nosed snake, when frightened, turns over on his back and plays dead. If turned right side up again, the snake seems to forget that he is "dead," for he promptly turns over on his back



DISPUTING A CLAIM

A male fence lizard dropped on the home log pile of another male by means of a thread attached to the pole, immediately calls forth a bewildering display of color





AN EXPERIMENT

A male fence lizard, his bright colors obscured with paint, is mistaken for a female

and always on or near his home log pile except for one day when he was 200 feet away along one of the roads. This lizard was transferred 790 feet from his home territory in a different direction from that of the road. The transfer was made across a dry, open field entirely unsuitable for

in determining which sex was the more adventurous. Both on rare occasions wandered beyond the confines of their home range. We recorded one female which moved thirty feet in two and one quarter hours and then four hours later advanced 230 feet more. No male exceeded this record.

The lizards do not remain in their territories because they are too stupid to go elsewhere. Fence lizards during the spring of the year are extremely vivacious and are moving actively about within the invisible confines of their territories. They stay in these ranges through choice as we proved by a series of experiments. One of our first was with a male which we had learned to know so well* that we had dubbed him the "Old Reprobate," there being something more personal in this appellation than in his real name "No. 59." Between April 2 and May 22 we had seen him on twelve different days

Sceloporus which prefers to keep within dashing range of cover. To our great surprise the "Old Reprobate" was back home in eighteen days.

We thought at first that the lizard might have moved south attracted by a cranberry bog rather than by any desire to reach home. Another male was therefore caught on the far side of the field and, when released on the bog side, a distance of 420 feet away, it worked its way home in seven days.

We made other tests on lizards whose movements previous to the tests were well known. There was a male whom we had observed on fifteen different days between



A FURTHER TEST

Another male, with limbs tied in such a way as to cover his bright sides, is also mistaken for a female



DIFFICULTIES

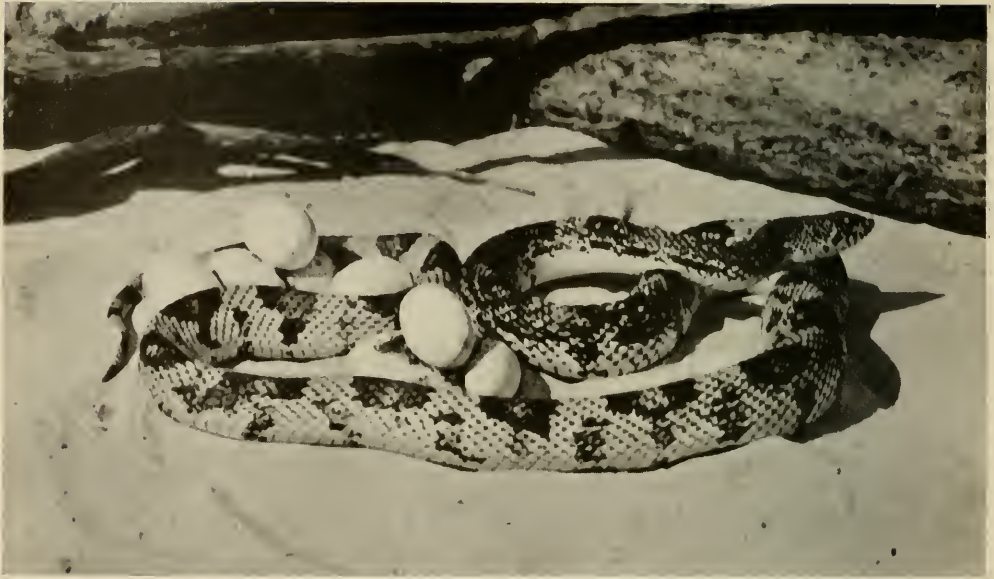
Even when the male has finally secured a grip on the shoulder of a real female she may object strenuously to this treatment

April 2 and May 23. When moved 760 feet across an arm of a dry cranberry bog, it made its way back in fifteen days. We may safely assume that for seven weeks prior to this move the lizard had not been over this route, for the farthest distance from home we had seen it was 150 feet. This raised the question whether the lizard recognized land marks at a distance or whether it was merely recalling wanderings made long ago. Tests which we made for distances more than 900 feet did not succeed, and many lizards were utter failures at shorter distances. Females, true to their reputation for adaptability, were usually much more content than males to remain in new territories where they were placed.

This difference between the sexes in their ability to find their way home is closely correlated with their different outlook on life. The males, as the season advances, become extremely pugnacious, while the females merely run from the intruder who comes too close. The different attitudes of the male and the female were readily demonstrated by the simple expedient of dropping into their territories other males and females attached to

threads on long fish poles. The males can recognize sex instantly. If a male is dropped into the territory of another male, the latter either goes into a full display, compressing his sides until the gorgeous blue stripe stands out in shimmering brilliancy, or else he dashes forward in a most violent attack. If the trespasser is a female, the male never displays but, giving a series of rapid head nods, runs forward to secure a grip on her neck. If a trespassing male resists, the guarding male follows his initial response with a bewildering series of displays and rushes, but no such demonstration of beauty and vigor is ever presented to the female unless the male is frightened or desirous of driving her away. This difference in behavior observed at frequent intervals throughout the spring clearly shows that the bright colors of the male fence lizard are employed to bluff possible rivals into withdrawing from a fight. The adornment of the male is not wedding finery but a gladiator's vestment.

Males could distinguish sex so rapidly and at such distances that we wondered just how it was accomplished. Females were therefore painted to resemble males



A DWELLER OF THE BARRENS

The pine snake, because of its large size and gentle manners, is a great favorite with snake charmers. This one captured near the field shown on the opposite page laid ten eggs of approximately the same size as those of a hen

and were dropped into the male's territory on long threads. This usually evoked the fight reaction. Others were painted with gold, silver, yellow, and other brilliant hues. Mercurochrome stained the lizards not red but green with a tinge of pink. Any gaudily colored lizard, whether male or female, was usually treated like a foreign male. Conversely, a male that had his legs tied in such a way that he did not show his blue sides was treated like a female. Similarly, anæsthetized males lying flat on the logs were actively courted. These experiments seemed to show conclusively that color was the chief basis of sex discrimination.

As the work progressed, it began to appear that other factors also entered into the problem. For example, one lizard which had a long record of attendance to a restricted territory was being tested with a choice between a firmly bound male and a similarly bound female. Before he could make up his mind which was foe and which mate, another male, which our records showed had been more prone to

wander, suddenly appeared five and one-half feet from the station of the first male. Without a moment's hesitation the male under examination jumped from the log and dashed after the other intruder male in the rough and tumble manner he treated all male trespassers.

During most of the year female fence lizards are distinguished from males not only by their somber sides but by much more distinct cross blotching of white on their backs. We wondered if this blotching might not aid sex recognition. We noted that one male would not court a male with the blue sides painted brown, but would court the same individual when white blotches were painted on his back. However, a female with the white blotches painted out was immediately recognized as a possible mate, and hence the blotches alone were not the *sine qua non* of femaleness.

From the very beginning of the work it was clear that the mood of a lizard would seriously interfere with consistent results. A male which was angered by seeing



A TEST FIELD

Fence lizards know their home territories. Individuals transferred to log piles on the opposite side of this field returned home within a few days. This ability to find their way home appears the more remarkable, because most of the lizards are stay-at-homes and wander very little in the course of a season



THE VOICE OF THE BARRENS

The male Anderson tree frog depends more on his voice than on his strength to woo a mate. His vocal pouch vibrates at each note. The call of one male starts all other males in the immediate vicinity giving their crescendo of quacks





MARCH IN THE BARRENS

The snow fall did not seriously delay the early appearance of the fence lizards

another male drop from heaven on a thread might require several moments of quiet before he could shift back into the courting mood. Since factors other than our own manipulations might change these moods, we found it very necessary to repeat our experiments many times. Frequent experimentation with the same lizard, if not tiring, had the disadvantage of training the lizards to respond to cues they would ordinarily fail to notice. For example, one of the males, who was subjected to the most continuous experimentation, toward the end of the season could distinguish a quiet male with the blue painted out from a quiet female. Another male having less experience with us failed to do so. We assumed that the first had learned to recognize the plain back as characteristic of the male regardless of the presence or absence of the blue. However, as we were about to complete this experiment, we found an untagged female in the second male's log pile. Whether or not this male had his powers of discrimination dulled by the presence of a female is impossible to say.

The movements of the two sexes are different and it seemed highly probable that these movements gave secondary

cues as to sex. For example, one of our most experienced males recognized the sex of a female with a broad stripe of white paint on each side of her body, and selected her in preference to a quiet female. The gait of an annoyed female during the breeding season is usually a series of hops with the head held close to the ground and the back arched. Male lizards are always excited by motion of any kind, and the jumpy type of locomotion may possibly excite more than the straight dash of the male. However, discrimination can be made even between quiet lizards. In the absence of motion, males during the breeding season will attempt to court any individuals of their own species which do not annoy them by a display of color.

Such a conclusion credits the male lizard with very little comprehension of the real situation. However, after courtship has begun, the comprehension is less. An anaesthetized male provided with a string around the waist to serve for a grip when pulled backward may be mistaken for a mate moving in the direction of the pull. This might be explained on the basis that the fence lizard has had no experience with lizards which walk backward. However,

in the absence of a show of color, male lizards frequently begin to court any lizard and sometimes individuals of other species. Once the initial grip is secured, the courtship unfolds in a regular pattern which is characteristic not only of *Sceloporus* but of related genera as well.

Lizards are sometimes credited with affection toward the opposite sex and cases of pairs living together for extended periods are cited as proof of the existence of a real bond between the mates. Such groupings might be brought about merely by the lizards seeking the same favorable territories. Since the female's dress does not excite the male to anger, he would make no effort to drive her out of his territory in the manner in which he would dispose of a male. In the fence lizard, however, we found that the ranges of the males were not always well defined. At one time three males lived together in one of the largest log piles under observation, and no one individual succeeded in driving out the others for some time. There was another case of a small log pile which was the territory of two males. Here one male was observed gripping a female in

courtship embrace on April 29. He was seen on this log pile on nine different days between then and June 9. Another male appeared there, our records show, on three days during this same period. Presumably the first male dominated this log pile but did not patrol it to the exclusion of all other males. Log piles are an attraction to both sexes because they offer places for sunning during the cooler days of early spring and an avenue of escape at all times. Bright colors have aided males to drive rivals from these points of vantage. The guarding males respond to the presence of another male with a display even after their own breeding season has passed. Bright colors have therefore been improved in the male line of many groups of lizards, for they serve as a warning that the territory is occupied and this in turn tends to prevent overcrowding. It is an advantage to the race for the males to be beautiful, for this scatters the individual territories of the males far and wide across the barrens. It is no wonder that some of the most abundant lizards are the most beautiful.



THE FIELD STATION AT CROSSLEY, NEW JERSEY



The Blue Jays Put Other Guests to Flight

A SEASON'S BIRD GUESTS

"At Home" to Furred and Feathered Inhabitants of Florida

By FRANK M. CHAPMAN

Curator-in-Chief, Department of Birds, American Museum

PHOTOGRAPHS BY THE AUTHOR

FOR the first four months of the year 1933 I lived on fairly intimate terms with a small group of birds at Little River, on Biscayne Bay, Florida. Some of them were natives and resided there permanently. Others, like myself, had come there to pass the winter. We met by chance. They were present when I arrived. I was unaware of their existence when I selected a winter home. I did, however, choose a "birdy" place, not because I planned to study birds but because I wanted their companionship. To the bird-lover a world without birds is a dead world; a mere shell of a world; a mockery of a world. Also, I was looking for a secluded place where, undisturbed, I could complete a book, and the presence of birds often means the absence of men and hence is an assurance of the freedom of solitude. Moreover, birds bring with them an atmosphere of good cheer; a

sense of well-being. Their vitality is "catching." One cannot be depressed when surrounded by birds. To "feel like a bird," as everyone knows, is to be at your best; and the way to feel like a bird is to live with birds.

There was nothing in my lease about birds. I could not ask my landlord to guarantee their co-tenancy. But, fortunately, the place was as "birdy" as it looked, and what follows is a by-product of this birdiness.

Our house is on "made" ground, and all the vegetation about it is of recent growth. This means that it is thick and bushy and gives cover. Where the new ground ends the old ground begins. This is a red mangrove swamp with a margin of willows, and grassy openings partly filled with the debris of the last hurricane.

Far enough within this swamp to ensure seclusion and concealment and at the head

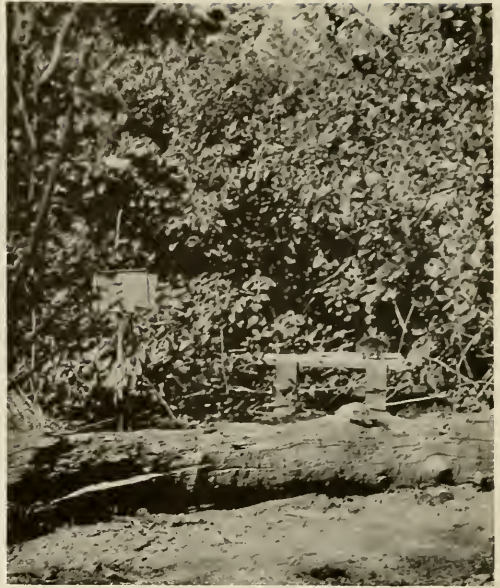
of an opening that gives an outlook, I built a little study. It measures six by seven feet and might better have been smaller. It is not beautiful, but I see it chiefly from within, and since the entire front and two large windows are of mosquito net most of the within is without. Behind this wire, when motionless, I appear to be invisible. At half-past three o'clock on the afternoon of December 27, 1932, three days after I took possession of this structure, a wild cat walked slowly, with several stops, past my doorstep. He seemed wholly unaware of my presence as I regarded him intently from a distance of seven to ten feet. I might have been on Barro Colorado. Within the following eighteen days I saw him twice at about the same hour.

"Couldn't you have killed him?" asked someone to whom I related this event. Of course I could have killed him. But of what possible use would have been a dead wild cat? Potentially, a living one has called on me every day for the past three months. He may come this moment,



THE LITTLE STUDY IN THE SWAMP

Behind the wire mosquito netting Doctor Chapman sat and watched his guests without being visible to them



THE BANQUET TABLE

In a sheltered nook stood the feeding-table spread with dainties

and this possibility places the seal of the wilderness on my surroundings. His visit was a real house-warming. The marsh advanced immeasurably in my esteem.

Possibly I should explain that, in my opinion, there is a marked difference between wild cats and tame cats in their relation to birds and man. There was a story current on Indian River years ago, that Brevard County, Florida, having paid out all the money in its treasury for bounties on wild cats, found itself unable to raise cabbages because of the resulting increase of rabbits. My wild cat, therefore, is, I believe, looking for the marsh rabbits, two of which live beneath my house and are now occupying my feeding-table. With them, in their apparent helplessness, I have every sympathy. I do not want them to be torn apart by a wild cat, but neither do I want the wild cat to starve. So I have remained neutral and feel no responsibility. These things were before I came.

But for the house cat I am responsible; and the only one that has invaded this



UNAFRAID

The most numerous among the guests which sought the banquet table in the mangroves were the buntings and the red-winged blackbirds

will carry a diner to safety.

I give now a list of the birds that have honored my board: 6 quail, 3 blue jays, 5 catbirds, 1 mockingbird, 1 hermit thrush, 1 myrtle warbler, 1 Maryland or northern yellowthroat, 1 ovenbird, about 25 red-winged blackbirds,

little sanctuary did not return. Likewise, I felt warranted in protesting to a house rat who seated himself at our table. The native cotton rat, on the other hand, has rights that I do not attempt to dispute. This table, indeed, with a pan filled with water, form my only attempts to induce the birds to alter their habits. They would, I know, prefer to take their food from the ground where, in the litter of leaves and sticks, they are less conspicuous. In fact, they always gather what is under the table before they come to the table itself. But I have insisted on the table because its use seemed to make the birds more my guests than if they ate from the ground, a feeling, I know, that is understood by everyone who has bird guests.

It should be emphasized, however, that I have set my table in a sheltered position, where it is not exposed to the sky above and is so near cover on three sides that a single flit of the wings

8 painted buntings, 8 cardinals. They were not accustomed to dining together, and it was some time before they became even partly accustomed to each other as well as to me. In this matter, as well as in many others, there was much variation reflecting both the character of the species as well as of the individual.

Before I speak of the behavior of my guests, I will give the menu that was placed before them. The chief course was "chick-feed," composed largely of cracked corn to which I added a liberal proportion of sunflower seed. Next in importance were suet and oranges, with bananas and raisins occasionally by way of dessert.

REDWINGS AND
CARDINALS

A pan of water set in the earth made an ideal drinking place for the visitors

QUAIL

A slab from a fallen tree formed an acceptable side-table for the quail and ovenbirds which would not mount to the main table

Water was supplied in a milk pan set in the earth. Its curled rim made an excellent perch. Returning now to the diners:

Neither the quail nor the ovenbird ever mounted to the main table. For the former I set a low table made of a slab from a fallen tree, which they used at once. They were my most welcome guests. With them came a spirit of peace and good-will. Living on terms of the closest intimacy, feeding so near together that often a hat would cover them, never by word or deed did they show the slightest trace of misunderstanding. On the contrary, in low, sweet, tones they maintained a running conversation expressive of cordial good-fellowship. When the quail came, all writing was suspended. Although they never accepted me as part of the environment, I could, nevertheless, share their spirit of contentment and enjoy their exquisite grace of form and motion. Unfortunately



they always seemed in a hurry. Nothing I could offer would induce them to stay longer than five or six minutes.

The ovenbird was like a dainty Quaker maid aged thirty-five or thereabouts. While in no way critical of her chance companions, she (I assume the sex) held herself very much aloof from them, picked her way with rapid, mincing steps where grain was scattered, and quickly retired to the privacy of her shady haunts.

Of the two other single warblers, the yellow-throat, an erratic, nervous, restless little bunch of feathers, personified perpetual motion. Bananas and suet were his choice with chick-feed next if they were not available. The myrtle asked only for suet.

The catbirds were individualists. Suet was their favorite fare, and they often made what looked like insulting gestures at each other while waiting their turn at the suet table.

The mockingbird also favored suet. With the

THE REDWINGS VISIT B'RER RABBIT

Birds and rabbits ate side by side after they became acquainted with one another





POSSESSION IS NINE POINTS OF THE LAW
A catbird and a cardinal have a brief misunderstanding

possible exception of the blue jays, he was the dominant species. When he appeared for a brief meal of suet and grain washed down with orange juice, the other birds retired. Doubtless because of his aggressive spirit he showed comparatively little fear of me, and would take his suet on the window-sill within reach of my arm.

The blue jays, boisterous in voice and manner, put other guests to flight as they greedily grabbed sunflower seeds, screamed harshly, yodeled softly, and then made off for parts unknown. One of them mimicked perfectly the whistle of the osprey.

In strong contrast to the flaunting vulgarity of the jays was the hermit thrush's modesty and gentleness. Supremely gifted, he sought no recognition of his unrivaled talents and was content

POSING FOR HIS PORTRAIT

Unwittingly a mockingbird makes a fine subject for Doctor Chapman's camera

to take his share of suet when other birds had eaten their fill.

The painted buntings, or nonpareils, were a joy to the eye. Matching the leaves in color, the females and young males were almost invisible when at rest in the foliage, but the brilliantly colored males, like diminutive trogons, were conspicuous anywhere, whether in motion or at rest, and were correspondingly shy. The leaf-green birds fed regularly on my doorstep, but only once was an adult male seen there. Not a single note did I hear from these birds during our months of daily association.

It was the cardinals that in more than one sense gave color to my table. Dashing, musical, responsive, they, with the redwings, were the most distinguished of my guests. It was not alone through their numbers that the redwings were conspicuous. As early as January 22 they began their choral singing, and their blended notes from the mangroves created a feeling of cheery companionship. As a rule the sexes were not associated.

The catbirds, nonpareils, cardinals, and three warblers and a thrush were always present; the quail, jays, and mocker came at intervals; the redwings evidently passed the night at some roost, doubtless frequented by others of their



kind. It was pleasant to see them come pitching down from the sky in the morning, and when they departed, late in the afternoon, I felt that the day was ended.

Of the barn owls that nested in a dead tree above my study, the pileated woodpecker that cleverly knocked the bark off it, the Ward's herons that roosted in the mangroves, and the ospreys that flew overhead, of these, and a score more I say nothing, for they were not my guests. They played a part in my life but I played none in theirs.

I must, however, speak of some recipients of my bounty who, although uninvited and unfeathered, took their place at table as though it had been set especially for them. First on this list I place the rabbits which I have already mentioned. They are not cotton-tails (*Lepus sylvaticus*), but marsh rabbits (*Lepus palustris*). The former frequent the front lawn of my home and come from an adjoining field. The latter feed in the back yard near its junction with the mangrove swamp in which they live. Thus we have the habitats of representative species meeting but not overlapping. Distributionally, the case is paralleled in birds by the house wren and long-billed marsh wren, but in that instance the species are not representative. The marsh



A SHARP-SHINNED HAWK FLIES OVER
Eternal vigilance is the price of life itself for this little redwing

rabbits evidently prefer chick-feed to anything that nature offers. They take it wherever it is placed, whether on the table or my doorstep, and are thus brought into close contact with the birds. At first they were given right of way, but their harmlessness was soon learned, and birds and rabbits ate side by side.

The land crabs, with whose holes the ground is mined, have also shown a marked fondness for chick-feed. A large one would fill a milk pan and a small bird would be helpless in their lobster-like claw, but the birds show no fear of them, evidence that they have no feeling for birds. Vegetation appears to be their normal food, and it is amusing to see them climb the low-hanging mangrove branches for leaves and carry them into their holes. Incidentally, these great crabs form a marked and



A REGULAR GUEST
The catbird obligingly comes within range of his host's photographic lens



UNINVITED DINNER GUESTS

A marsh rabbit and a house rat together share the bounty provided for the birds

none too pleasing feature of the landscape. Not less than two score lived within fifty feet of my study.

Blue-tailed lizards that make their home in the crevices of my doorstep log, and a four-foot "racer" snake that occupies a hole beneath it complete the list of my more conspicuous neighbors. At irregular intervals the racer starts rapidly on some mission in the swamp and is soon lost to view. At times I see him return to pour himself into his hole; a thin, sinuous stream of fluid flesh.

The first thing that impressed me about my bird guests as a whole was that apparently the same individuals came every day. I made no attempt to "band" them, that is, place numbered rings on their legs, for I determined to let nothing interfere with the work that had brought me here. But some birds could be distinguished by certain marks, others by their actions. For example, a quail had several white tail-feathers, a male redwing had but one foot, and in another's breast there was a single buff feather. A male cardinal had

lost his inner wing-feathers, and the single individuals of mocker, thrush, and warbler were known by their gradually increasing tameness, their familiarity with the regular feeding places, and their uniqueness.

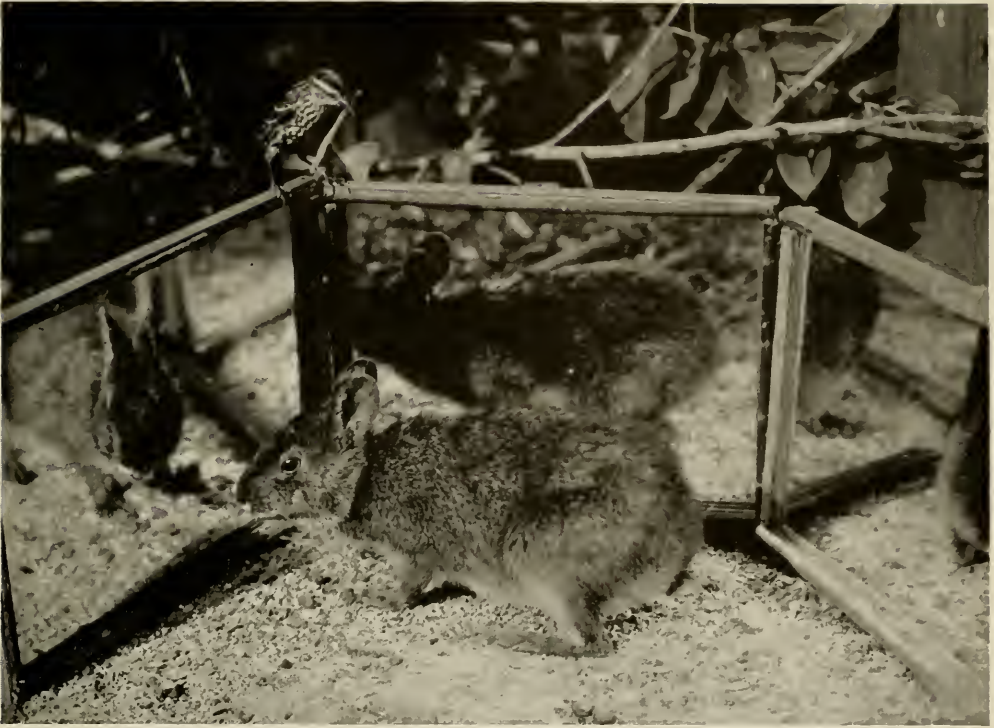
My second generalization is therefore a corollary of my first; namely, that from mid-November, when I first distributed food for birds, until migrants came at the end of April, when I left for the north, not one bird was added to my list of daily visitors. There were vacancies at my table of which I shall speak later, but never was there a request for an additional seat. This to me expresses a surprising degree of stability in winter bird population. That, given an abundant and never-failing supply of acceptable food, I should hold the birds I found present when I arrived, was to be expected, but that this same food did not attract others was equally unexpected.

All these birds lived in constant apprehension of attack by hawks. I will not say fear, for I do not think they experience the sense of fear any more



LAND CRABS

Not less than two score lived within fifty feet of the study retreat in the swamp



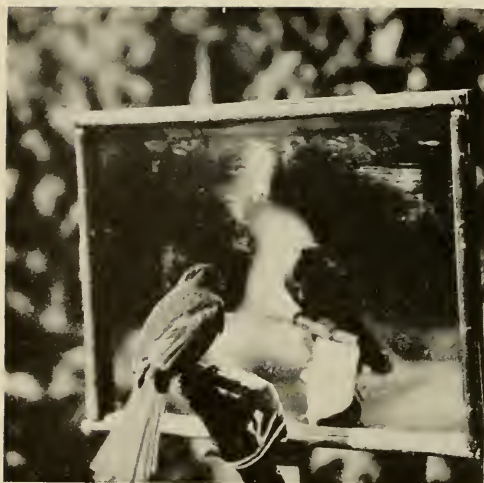
FASCINATING REFLECTIONS

A marsh rabbit has a good look at himself, with a female redwing for audience

than does the child who plays in a crowded street and is constantly, automatically, on the alert to escape passing vehicles. Eternal vigilance is the birds' normal attitude toward life. Four times during the winter I saw a sharp-shinned hawk dash through my dining-room, and if the diners had not all been prepared for his coming, one of them would have lost his life. This preparation, or training, they acquire through their response to false alarms. At more or less frequent intervals throughout the day, with a startling rush of wings, every bird dashes for cover. I look up to see the cause and find none. But some bird (often it was a catbird) has given an alarm note understood by the others and, without pausing to ask questions, they all spring for the undergrowth. No matter how often the warning is sounded, every bird responds to it. If it is a false alarm, they all return within one or two

minutes and resume feeding as though nothing had occurred. But if it is a real alarm and the swoop of the sharp-shin has actually cast the shadow of death upon them, then it will be a half hour or more before a single bird reappears, and community life is more or less disorganized for the rest of the day and even the following day. The birds are all much shyer, they venture only a short way from cover, the false alarms are given more frequently. We see now why bush and tree-haunting birds hesitate to visit feeding-tables far removed from the growth which is their haven of safety.

As my bird guests became increasingly appreciative of my attempts to cater to their tastes, and, instead of retreating, actually came from their hiding-places when I appeared, so they became increasingly companionable and occupied so large a share of my attention that my



A CHALLENGER APPEARS

Tertialis, the cardinal,
finds a rival in the
mirror

writing suffered correspondingly. I had intentionally left my camera at home to avoid the temptation of using it, but so many subjects offered themselves at my door daily that I finally wrote to the Museum for a photographic outfit. With this in my hands I deliberately neglected my work in order to secure portraits of my visitors. Some of the results, presented herewith, speak for themselves. Others call for a word of explanation.

In order to observe a bird's reaction to its own image, I placed mirrors on the ground and also behind the suet perches. At first surprisingly little attention was paid to them. A female redwing sought their reflected heat for a sun-bath. The photograph shows her as, with tail spread, wings dropped, bill open, and rump feathers raised exposing the oil gland, she invites the rays of the sun, but it does

not show the peculiar, twisting motion by which she presented first one side of her body, then the other. A male nonpareil, and a catbird, presumably a male, once made a slight effort to reach their image; the male yellow-throat attacked his image daintily, but it remained for one of the cardinals to wage constant and violent warfare against the intruder in the glass. This was the cardinal that had lost its inner tertials and hence was easily identified. About March 1 he established his singing perch in a mangrove at the left of the table, and his ringing, melodious whistle gave notice to all concerned that he

claimed this place and its immediate surroundings as the site of his future home. None of the other male cardinals ventured to dispute his right of



A VALIANT ATTACK

Tertialis springs toward his rival in the glass

THE PHANTOM FIGHTS

Tertialis pecks and flutters, but receives blow for blow



possession. Indeed, they appeared to recognize it and made only brief visits for food, whether on table or ground, retreating when the master of the territory appeared. Then one day (it was March 4) a male cardinal appeared at the ground feeding-place who not only showed no fear of "Tertialis," as I called him, but met his advance step for step, and when Tertialis sprang toward him he repeated the motion and sprang forward to meet the attack. Tertialis pecked and fluttered and, with equal vigor, his rival pecked and fluttered back. But he was a mysterious opponent, this mirror bird, a phantom fighter who met you blow for blow and still never could be reached. Small wonder that Tertialis was puzzled. After each round he invariably went behind the mirror and then hopped up on it, but nowhere could he find the valiant trespasser.

Nailing the mirror to a stake, I placed it behind the suet four feet from the ground, but Tertialis followed it, and as the season advanced and his song was designed not only to announce his territorial rights, but to attract a mate, he attacked his elusive rival with increasing fierceness. Wanting still to test the reactions of the mockingbird and catbirds, I left the mirror in position, but, when absent, I covered it with a cloth, and Tertialis looked in vain for his enemy. On one such occasion he voiced his defiance in song perched on the concealed

mirror. When I was present, and the mirror was uncovered, I had to go out at frequent intervals to drive him from his equally tireless image.

Meanwhile, as I have said, mating time arrived. The female cardinal is not merely a passive wife and mother. The fact that she sometimes sings shows that

she may have a voice in the affairs of the family. So a female cardinal was the only definitely recognized female that responded to her image. A cardinal's crest gives it, for a bird, a wide range of expression. Erect, it interrogates, like raised eyebrows; lowered, it gives to the bird a sinister, threatening look, and it was with flattened crest that the female confronted her double and at the same time rapidly vibrated her outer primaries. At



TÊTE-À-TÊTE

A mockingbird lunches almost at the elbow of his host

times this shivering, trembling motion was given to the entire wing, but usually it was confined to the feathers of the outer joint of the wing, over which, independent of the remaining wing-feathers, the bird evidently has control. I had seen females do this before. It apparently expresses excitement. In any event, the subsequent actions of two females led me to believe that the female before the glass recognized in her image a claimant for the attentions of Tertialis.

Courtship among cardinals, at least among my cardinals, is clearly not a one-sided affair. The female is not merely to be wooed and won. She takes part in the wooing. During the first week in April

two female cardinals dashed in and out of the singing-tree in reckless pursuit of each other. Sometimes *Tertialis* took part in these wild flights, but just what part he played I do not know. On April 8 one of these aerial displays ended on the dining table where the two females, locked in anything but a loving embrace, clawed and pecked one another for not less than five seconds, and the number of feathers released explained why they both had looked so dishevelled. This was probably not their first fight. Four days later on this same table I saw *Tertialis* gallantly present a female with a sunflower seed and then insist upon her taking another, and I assumed that she already had accepted his heart.

April 15, I determined to see if I could learn over how much ground *Tertialis* claimed jurisdiction by moving the mirror

away from his singing tree. Without using suet and setting it on its stake with the cardboard back toward the bird, I found that he soon followed the glass at about 25-foot spaces until it was 109 feet from his song perch, when it seemed to have passed beyond his territory. The following day he made a first flight of 60 feet to attack it, and on the 17th recognized it at 75 feet, although its back was toward him, and within half an hour after it had been set in position, he was vigorously attacking his image. I made no attempt to carry this experiment further, but it seems to indicate that a mirror might in some cases be successfully used to measure territorial boundaries.

By way of a guest-book I kept a daily record of my visitors, and, as the weeks passed, I found that bird after bird failed to respond to the roll call. A male car-



CATBIRDS DISAGREE

The suet spread for their delectation is a much coveted morsel often leading to many arguments



AN ACTIVE MARYLAND YELLOW-THROAT

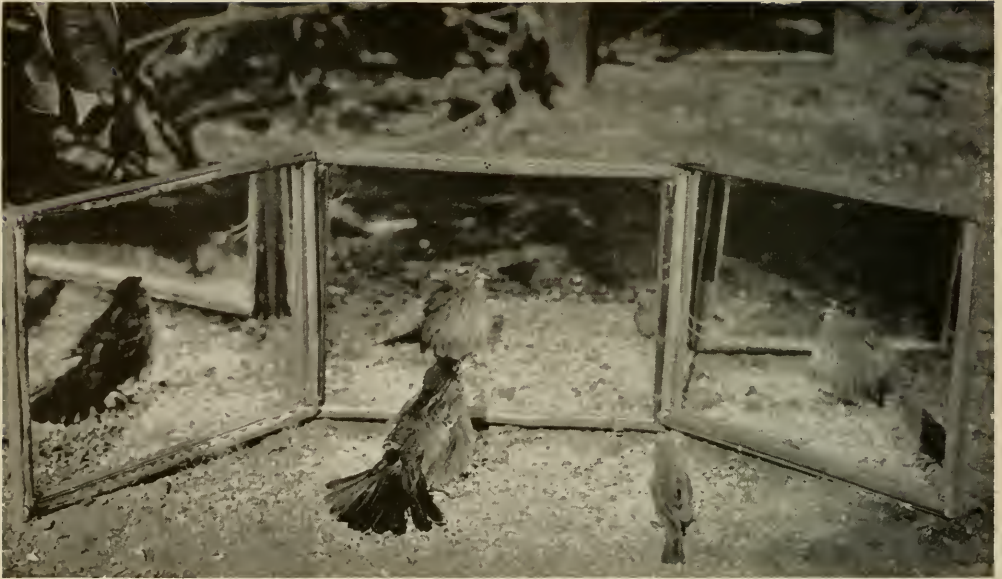
Only a single individual represented this species at the banquet table, and the above portrait was quite a bit of luck, for they are not often photographed

dinal was the first delinquent. On the morning of January 26 I found his remains near my study. Presumably he had been killed by a sharp-shinned hawk, and but a short time before. It was an hour before a bird ventured beyond the feeding-table. They were all exceedingly nervous and flew to cover at frequent intervals. At 11:30 a sharp-shinned hawk dashed through the opening, confirming my belief in his presence. All the birds flew into the surrounding growth and twenty-nine minutes passed before one appeared.

On February 10 my little flock of six quail appeared for the last time. They had been coming daily, sometimes both morning and afternoon. Their fate remains a mystery. I heard no shooting; indeed hunting is prohibited in this vicinity. While a predator might have captured some of them, I cannot believe that he could kill all of them. It was too early for them to mate, nor have I heard their mating-call or any other note from them since their disappearance. They may have been trapped, but I try to think that they have changed their local

range and are still chuckling cosily to one another somewhere.

February 25 I first noticed a female red-wing who apparently was ailing. When an alarm was given and all the other birds darted for shelter, she often would be left behind. If a hawk had been hunting, she would have been captured. As the days passed she became more helpless. Apparently her throat was affected. She tried to call but could only gasp a feeble *seep-seep*. Finally on March 2 she became so weak that she fell into a crab's hole. To save her from a worse death I rescued her and, after futile attempts to find the cause of her sufferings, put an end to them. Dissection showed that her entire pectoral cavity was filled with filarian worms. Her death, as well as that of the cardinal, would, I suppose, in avian mortality statistics, be attributed to natural causes. So rarely is an autopsy possible that we know little definitely about the causes of birds' deaths in nature. But it is probable that, primarily at least, far more birds die of diseases occasioned by bodily parasites than through capture by predators. Moreover,



THE SUN-BATH

The reflected heat from the mirrors induces a female redwing to take advantage of the opportunity to bask in its warmth

it is possible that many of the victims of hawks and owls have been weakened by disease. Nature has no mercy for bird or beast not in possession of all its powers.

I have spoken of a male redwing with only one foot. He has been observed almost daily since February 18 and may have been here at an earlier date. He is now (April 15) in full plumage, seems to be in good condition, calls his *okalee* lustily, but nevertheless is apparently an outcast. The other males have gone and he is left behind. Handicapped by his infirmity, he cannot take wing as quickly as a bird with two feet, and some day his deformity may mean to him the difference between life and death. If he does not move quickly it apparently will prevent him from securing a mate.

My four winter visitants from the north were last seen on the following dates: myrtle warbler, February 13; ovenbird, March 21; northern or Maryland yellow-throat, March 25; hermit thrush, March 29. Each of these species was represented by only a single individual.

Their prolonged, regular, daily attendance, indeed residence, argued against a change in local range. I concluded, therefore, that they had either met with some mishap or had started on their journey toward the north. It may have been too early for the myrtle warbler to leave, but the migration dates of the three remaining birds support the belief that they had actually begun their flight to the nesting grounds.

We accept the marvel of a bird's return to its summer home as a manifestation of the season. The rising temperature, the development of the vegetation, the appearance of insects, all combine to create the effect of a cause to which the migrating bird responds. But viewed from the other end, the causes of migration are not so obvious. Why should my warblers and hermit thrush desert a food supply which for months had not failed them? Why should they leave climatic conditions which were daily becoming more summer-like to follow the wake of retreating winter to a land where the food supply was still at the minimum?



THE OUTLOOK FROM THE
STUDY

On the log in the foreground
the wild cat walked



A DINNER GUEST
ARRIVES

Two marsh rabbits lived be-
neath the study and were
particularly fond of the chick-
feed which formed the chief
course at the banquet



For months they had not associated with others of their kind. Each bird, therefore, had to get under way on its own initiative, and, furthermore, begin its travels, probably at night, when for months it had been sleeping snugly from dusk to dawn. I knew, and they did not, that some day they would receive a call they must obey, and knowing, too, the dangers they must encounter on their unmarked route, I regarded them with the respect we accord doers of great deeds. Who sounds the call? Forty years ago (*The Auk*, 1894, pp. 12-17) I attempted to answer this question, and the reply has since been abundantly confirmed. Impressed by the fact that the brown pelicans of Indian River and the terns of the Tortugas returned to their nesting grounds with the regularity of a May migrant, I concluded that their call came through neither food nor climate nor other external influences, but from within themselves.

Birds, like plants, pass through an annual physiological cycle. With the plant,

after a period of rest, sap begins to flow, and bud, leaf, blossom, and fruit follow each other in orderly succession. After the leaves fall, the resting time is reached again. So, too, the bird rests until with the approach of the nesting season its "sap" begins to flow; in other words, its reproductive system begins to develop toward the functional stage, and there follows the return to the nesting-grounds (which is migration), mating, nest-building, egg-laying, incubation, the care of the young, the molt, return to winter again and the resting season.

So my warblers and hermit thrush were unconsciously obeying a fundamental law of their nature when they started on their journeys of a thousand miles or more to the region of their birth. I was sorry to have them go, but I should have been much sorrier to have them stay and, like the one-footed redwing, lose their place in the annual cycle that makes their lives and ensures the continued existence of their species.



A CATBIRD APPROACHES ITS OWN IMAGE



Mongolian Camel Herders Carrying Native Lassos

NOMADS OF THE DESERT

The Romance and the Tragedy of the Mongols—an Independent Race of People
Living a Primitive Existence on the Plains of Mongolia

By ROY CHAPMAN ANDREWS

Curator-in-Chief, Asiatic Exploration and Research, American Museum

IF a Mongol of Genghis Khan's time should suddenly drop into the middle of Mongolia today, he would be perfectly at home. He would find that the everyday business of life, except in a few minor particulars, is carried on almost the same as in his day seven hundred years ago. There has been no reason to change the fundamentals of existence. The environment is almost exactly the same. It is still a pastoral life.

The Mongols are true nomads. They remain in one spot only as long as the grazing lasts. They must not hamper themselves with unnecessary household goods, or it would be too difficult to move. Therefore, they have developed no arts. Even though under Genghis and Kublai Khan they conquered half the then-known world, they left nothing constructive behind. They were destroyers. They had nothing to give to the conquered peoples. Culture, art, architecture did

not enter into their lives. These could not be developed in a nomadic people living a wild, restless life upon the plains and deserts, with the struggle for existence against the forces of nature ever present in their minds.

The only thing that has altered radically in the Mongol race is the spirit of the people and their religion. A Mongol of Genghis Khan's time would find them no longer a race of warriors. He would find that two thirds, at least, of the male population had donned the yellow and red robes of lamas; that they had become dissolute human parasites. It would be difficult for him to adjust his mental perspective to such a state.

There were several contributing causes to the decay of the Mongols as a race, but the primal factor was the introduction of Lamaism. Before this they had been Shamanists, worshiping the spirits of nature that lived in the rocks and trees



A MONGOLIAN WOMAN

Her hair is elaborately done up with a braid hanging free at the end of each decorative "horn." This is worn night and day

and mountains. About 1294 Lamaism became the religion of the state. Its teachings are against war, enterprise, ambition. Fostered by the Chinese, who realized its value in subjugating a war-like race, it obtained such a powerful hold over the superstitious nomads that it became the paramount factor in their lives. The authority of chieftains and generals gave way to that of Buddhist priests.

Custom decreed that the first-born son of every family should become a lama. Sometimes all the male children joined the priesthood. Many of them remained permanently in the temples which had sprung up over all the country. Those who returned to their *yurts* had learned

habits of slothfulness and were periodically at the call of the ruling lamas of their district.

Nevertheless, I believe that the Mongol of today is quite equal to the warrior of Genghis Khan's time so far as hardihood and endurance are concerned. Moreover, the present-day Mongol is an excellent fighter as recent events have shown.

In that terrible winter of 1921 the "Mad Baron" Ungern-Sternberg, was assisting the Mongols in driving the Chinese out of their country. Several thousand Chinese soldiers were encamped near the root of an ancient mountain named Tuerin, 150 miles from Urga. Baron Ungern sent several companies of Cossacks to attack them, but a Mongol general learned of the proposed attack and wanted the fun for himself. He had only 300 men; each one of them took a led horse and rode

the 150 miles to the Chinese camp in an incredibly short time. They arrived just at daylight. Without regard for the enormously superior number of Chinese, the Mongols attacked at once.

The general, whom I knew well, told me about it in Urga. "We rode at full speed through the camp," said he, "killing everyone we saw. Then we rode back again. We did not have to waste many cartridges; we cut most of them down with sabers."

The Chinese ran like sheep and the 4000 soldiers were almost annihilated. Those who were not killed in the camp fled into the desert half clothed and died in the bitter cold, or were hunted down and

butchered by the Mongols. Except for the modern weapons, the story might have been a thousand years old, for this method of warfare was a heritage from Genghis Khan. Hours of hard riding, regardless of sleep or food, a sudden whirlwind attack, and then relentless slaughter.

Although the Mongols are lazy under ordinary circumstances, they are not always so. Laziness is largely a product of their pastoral pursuits. Herding sheep, camels, and ponies ordinarily requires little effort, but at certain times their life demands extreme exertion and then the energy and endurance which they display are amazing.

The wild free life of the plains has made the Mongol exceedingly independent. He relies entirely upon himself, for he has learned that in the struggle for existence it is he, himself, that counts. Of the Chinese the opposite is true. His life is one of the community and he depends on his family and his village. He is gregarious above all else and he hates to live alone. In this dependence upon his fellow men he knows that money counts—and there is very little that a Chinese will not do for money! The personal equation enters very largely into any dealings with a Mongol. If he likes you, remuneration is an incident. If you do not appeal to him, money tempts him but little.

The entire life of the Mongols is the product of their environment, which is and has been dependent upon climate and geography. The country is too dry, cold, and windy for agriculture, except in the southern grasslands.

Their independence, love of sport, hospitality, and admiration for the strenuous elements of life are a direct result of the conditions under which they live.

In the real desert, sheep, goats, and camels are the only animals that can exist in numbers upon the sparse, dry vegetation. In the grasslands, ponies and cattle are to be seen in considerable herds.

A Mongol's wealth is always estimated by the number of animals which he possesses. Even the poorest natives own at least one pony and a few sheep or goats. During all my years in Mongolia, I have seen only one beggar on the plains, and he rode a very decent pony! Before the



A LAMA WITH HIS ROSARY

Mongolia is heavily burdened by the great numbers of lamas who produce little or nothing, and must be supported by the people of this sparsely settled land



A HERD OF SHEEP NEAR THE TOLA RIVER

Mongolians are herdsmen, whose sheep, camels, and ponies form the greatest part of their wealth.
Even the poorest owns one sheep or goat



WATERING SHEEP AT A DESERT WELL

Wells have been dug along the main caravan trails and in many other parts of the desert where there is sufficient vegetation to support flocks of sheep or goats. The water is usually good



MILKING TIME

Tied with their heads toward the center of their enforced circle, these goats are patiently awaiting the milkers



MARKETING SHEEP AND GOATS AT URGA

Few towns are to be found in Mongolia, but at Urga, the capital, the Mongolians from the desert periodically engage in barter and trade



A CAMEL CART
AT URGU

These Mongols are engaged in shifting from one camp to another—not a difficult task, for their belongings are never numerous or bulky

water. They cannot remain in the mountain valleys during the winter, for the snow lies so deep that their stock would be unable to dig down to the grass beneath it. On the plains the high winds sweep large areas bare, piling the snow into drifts.

Soviet Government assumed control of Outer Mongolia, the princes had herds of ponies, camels, sheep, and goats, numbering many thousands. Cattle are comparatively few.

Although Mongols are necessarily nomads, they move only within certain prescribed limits. At a meeting of the inhabitants of a district with their officials in the early spring, grazing grounds are allotted to each family or village. They must adhere rigidly to these allotments. How many times they move depends entirely upon the grass. If mountains are near by, the Mongols go well up into the valleys during the summer, where there is better grass and water. In the winter they return to the plains. There are many parts of the desert where grazing is fairly good but where water is not to be had. Usually the natives go there in the winter, depending upon snow for

Since animal droppings (*argul*) are the only fuel and these burn rapidly, a considerable quantity is accumulated for winter use. Sheep dung is made into large bricks during the summer, and these are frequently piled about the yurt as a wall. This acts as a windbreak for the dwelling, a corral for the animals, and a fuel supply. If a family moves away from such a place in the spring, leaving a quantity of unused *argul*, other Mongols do not take it, as they know the owners will return.

A Mongol's real home is the back of a pony. He is uncomfortable on the ground. His great boots are not adapted for walk-



WOMEN SPECTATORS AT
A "FIELD MEET"

The Mongol is naturally interested in sports and athletics. The men are excellent riders, and are fond of horse racing

THE FESTIVAL OF THE COMING BUDDHA

The Premier of Mongolia, seated in the foreground, is shown at the "Festival of the Maidari." He wears a magnificent robe of cloth of gold

ing and he is so seldom on foot that to walk a mile is punishment. To go only a hundred yards or so he will jump on his pony, which always stands hobbled within reach. Children learn to ride in infancy. Each year, in the spring, a juvenile race was formerly held at Urga. Boys and girls from four to six years old were tied on ponies and rode at full speed over a mile-long course. If a child fell off, it received but little sympathy, and was strapped on again more tightly than before. A Mongol has no respect whatever for a man or woman who cannot ride, and nothing will win his admiration so quickly as good horsemanship. Mongols usually ride either at a trot or a full gallop. They use a broken snaffle bit and ride with a loose rein, always swinging the whip, which is a short stick with a lash at the end.

Ponies are fairly cheap in Mongolia,



but not extraordinarily so. Racing is almost a business and if a native owns a fast pony he is a lucky man. He goes to the annual field meets at all the temples in his neighborhood and will race for a sheep or a goat in the interim, or just for sport. The races are really endurance contests. Five to ten miles is the usual distance and I have known some races to cover twenty miles. The ponies are ridden by boys twelve or fourteen years old, who beat their mounts from start to finish.

Next to horsemanship, the ability to shoot is most admired by a Mongol. Almost every native possesses a flintlock gun with an enormously long barrel.

Its effective distance is hardly a hundred yards and they seldom shoot even at that range. They do not shoot offhand. Mr. Larsen speaks of the ability of a Mongol to shoot from a galloping horse, but I never have seen one even attempt it.

GATHERING FOR A "FIELD MEET"

Contestants are shown here as they gather for an energetic display of skill in wrestling, riding, and other sports





THE FRAMEWORK OF A YURT

The *yurt* is a type of dwelling admirably suited for the windy plains and deserts, and also for the nomadic existence of the Mongol

Two long sticks are attached to the barrel on either side and these are used as a rest. When carrying a gun, the Mongol folds the sticks back on either side of the stock. The Mongols never ceased to talk about the ability of our men to shoot running antelope offhand at three or four hundred yards.

Every year the natives of each district in Mongolia hold a field meet. Usually these are at temples; sometimes at *obos* (religious monuments). Horse-racing, wrestling, shooting, and, rarely, archery contests are the order of the day. Mongols gather from long distances, dressed in their finest clothes, and sometimes remain for a week or more.

The Mongol has developed a type of dwelling which is admirably suited for his nomadic existence and for the windy plains and deserts. A circular lattice framework is covered with felt. Because this material is such an excellent non-conductor, the yurt is warm in winter and cool in summer. It can be dismantled and packed upon a camel with all the

household goods in less than half an hour, and the family is ready to move to a new grazing ground.

In the center of every *yurt* an argul fire burns, and over it the family cooking is done in a great iron bowl. Tea and milk are boiled together, ladled out into tall cylindrical brass-bound pitchers, and passed about to be poured into the small wooden eating bowl which every Mongol carries in his, or her, gown. As often as it is available, mutton or other meat is boiled in the great pot and eaten with the fingers and the aid of a sheath knife.

Mutton is their favorite food. They prefer it to any other kind of meat. The mutton is good except where the sheep have been eating the small wild onion which grows abundantly everywhere on the desert. Then the flavor is decidedly "oniony," but the Mongols consider that a distinct asset. I have never seen the Mongols prepare meat in any other way than by boiling. Since they are a pastoral people they have almost nothing to eat except animal products. Butter, cheese,

milk, meat, and tea are their ordinary food. Now and then they obtain a little flour from the Chinese traders and make a kind of bread fried in grease, but the poorer natives cannot afford to indulge in such luxuries.

The Chahar and other Mongols who live in Inner Mongolia, where they are in closer touch with the Chinese and an agricultural region, use a great deal of flour and other vegetable foods such as potatoes and millet. On the slopes of the Altai Mountains we found a few wild onions and rhubarb. The latter the natives use only as a medicine, but the onions they eat raw. In the spring I have seen them eat the pods of young milkweed and in the autumn the fruit of the dune berry, *Nitraria schoberi*. One might suppose that such an exclusively animal diet would be unhealthful. Such is not the case. During the long, extremely cold winter they must have heating food and, like the Eskimo, the Mongol requires meat and much fat.

Mr. Joel Eriksson, who has conducted a

medical mission in the grasslands for fifteen years, has given me a good deal of interesting information regarding the diseases of the Mongols. About ninety per cent of all men and women who come under his observation suffer from venereal diseases. After that, scabies is certainly the most universal complaint. Because of the common lack of cleanliness, almost every sort of skin disease that "flesh is heir to" appears at some time. Muscular rheumatism is almost universal, due to exposure, cold *yurts*, et cetera. Eye troubles are very prevalent, such as conjunctivitis, cornea sores and ulcers. These are engendered by sandstorms out-of-doors and constant smoke within the *yurt*.

Tuberculosis is decidedly uncommon. It is doubtless prevented by continual sunlight and the open-air life. Indigestion is a common complaint, and bronchitis in winter is almost universal. Smallpox is prevented to a considerable extent by vaccination, which is given to every child from four to ten years old by the lama



A COMPLETED YURT

The framework has been covered with felt, making a dwelling that is warm in winter and cool in summer. The women in the picture are southern Mongolians of the Chahar region



INVESTIGATING AN AKELEY MOTION PICTURE CAMERA

This was an object of unusual interest to the natives

tients segregated. Scurvy appears only in the spring, but at that time it is very common, because the Mongols then have no fresh meat or milk. They are living on meat killed the previous autumn and kept frozen during the winter. From the end of November to the beginning of June,

doctors. They use the Turkish method. Crusts from a newly recovered patient are gathered and ground up with pearls and other substances which are supposed to weaken the germs. The more precious the dilutant the more effective the medicine, they believe. This powder is blown into the mucous membrane of the nose of the child. The patient is thus given a regular case of smallpox, which may be light or severe. Often the children die. There are certain lama doctors who seem to have very few deaths to their discredit, and naturally these are most popular. After vaccination the child is confined in the *yurt*, and the parents try to prevent it from pulling off the crusts. Frequently an entire village will be vaccinated at one time.

Typhoid fever is often seen, but is not really prevalent, and typhus is rare. The lamas recognize infectious diseases and try to keep such pa-

the Mongols kill no stock, because the animals are all thin. Scurvy begins to develop in early April, but few people die of the disease. The natives are thoroughly familiar with its symptoms and know that almost any green vegetation will arrest its progress. Since nettles appear earlier than anything else, they eat quantities of this plant.

While we were at Shabarakh Usu and Kholobolchi Nor in 1925, Doctor Chaney obtained from lama doctors a list of plants which the Mongols use in their medicinal work. Many of the lamas were educated in Tibet, which accounts for the considerable number of Tibetan



A SOURCE OF AMUSEMENT

The Mongols were greatly entertained by looking through the view-finder of a kodak. Of course they did not understand what the camera was used for



THE INTERIOR OF A YURT

The family is gathered around an argul fire over which the cooking is done in a great iron bowl. Each man, woman, and child has a wooden bowl of birch or maple which he carries in the fold of his gown, and which is never washed but licked clean with the tongue

names applied to the remedies. As a rule, the part of the plant used is boiled and the dose is taken in the form of the tea which results. I submitted this list to Dr. Bernard E. Read, professor of pharmacology, Peking Union Medical College, with the request that he indicate which of these plants have value in modern medicine. Doctor Read very kindly annotated the list, and said:

"Some of the plants, in fact practically all of them, occur in the materia medica of some ancient medical system but their scientific value is probably insignificant."

He further remarks that only two have any place in modern medicine. One of these is rhubarb, *Rheum undulatum*, a well-known purgative; the other is ephedra, *Ephedra equisetina*, which contains ephedrine, very good for asthma and respiratory disorders. Of pepper-weed, *Ruta*, he says: "*Ruta graveoleus* used to be official and is occasionally used in hysteria." *Rosa acicularis*: "Rose preparations are known the world over for their mild aromatic and astringent value."

It is very surprising to me that the

Mongols have not found more plants that really are efficacious in disease.

One seldom sees sick Mongols. I suppose one of the reasons is that if a person is very ill the relatives simply decamp and leave the invalid to die. Believing that evil spirits take possession of a body as soon as life is extinct, they are extremely loath to have anyone die in their yurt. I have often seen the mute evidences of a desert tragedy—a skeleton lying beside the dead ashes of a fire; near-by a wooden bowl with a little food; there, the circular mark left by the yurt. The story was plainly told. The person was about to die and the other members of the family had moved to new grazing grounds, leaving the invalid to pass the last moments of his life alone in the desert.

The Mongols are very superstitious about human remains. Under no circumstances will they touch or disturb a skull or skeleton. As soon as a person dies, the body is dragged off to a considerable distance and left to be devoured by the dogs, wolves, and birds. Sometimes the corpse is placed upon a cart which is driven rapidly over rough ground. At



A WRESTLING MATCH

Field meets at which horse racing, wrestling, and shooting contests form the principal part are held annually all over Mongolia

to offer what he has to other travelers.

I have often had Mongols ride several miles to bring my ponies to camp or tell me in which direction they had strayed; they would expect as much themselves in similar circumstances. To be left without a pony is

some point the body falls off. The driver does not look back for fear that he will be followed by the evil spirits of the dead. At Urga there are several places not far from the city where corpses are left to be devoured by the dogs, and I managed to obtain a fine series of skulls for anthropological study.

Life in the desert and on the plains of Mongolia is much like that of our own west in the pioneer days. Similar environment has developed similar customs. As in western America, hospitality is a law in Mongolia; assistance to a traveler is taken as a matter of course.

When one comes to a Mongol *yurt*, he enters and sits down beside the fire, feeling sure of his welcome, and is helped from the common pot. He may stay a day or several days without thought of payment. Every Mongol knows that he himself will ask for hospitality many times during the year and thus he is ready

a serious matter, for the distance between wells in the desert is often great. Horse stealing is a capital crime. In the old days if a Mongol reported that a pony had been stolen, soldiers took up the trail and followed it until they ran the thief to earth; usually he was shot at once.

Next to ponies, dogs are probably the Mongol's most valued possession. The large Tibetan mastiff is the usual breed but smaller mongrel dogs are found everywhere. All are exceedingly savage. They make excellent watchdogs for *yurt* or caravan and are trained to attack on sight. It is dangerous to approach a *yurt* unarmed. In Urga the dogs eat



ROLLING FELT

Felt is a most important material to the Mongol who uses it in making his dwelling



AN EXCITING MOMENT

Here lamas are catching and branding wild horses in a compound at Urga

human remains and are fed by the lamas. It is a crime to kill a dog. I have never seen a dog inside a *yurt*. The owners do not pet them, for savageness is a virtue.

I have had several very narrow escapes from being killed and eaten by Mongol dogs, for when they are hungry they will attack a man like wolves. If one dog of a pack is injured and yelps, the others will tear it to pieces instantly. Doctor Berkey was attacked and probably would have been killed had he not shot the dog; almost all the men of the Expedition had more or less narrow escapes.

Every newcomer in Mongolia is impressed by the rapidity with which news travels great distances; it is often believed to be due to some telepathic method of communication which has been developed by the natives. It is true that news does travel in an amazing way, but I believe that the explanation is quite simple.

The wells all over Mongolia are the natural meeting places and concentration points. Here the Mongols gather to water their stock and to gossip. If a traveler is near a well he will always ride over to see who is there and to hear the news. There is little to talk about and

the slightest novelty is discussed and re-discussed for hours. Very often a Mongol will ride forty or fifty miles to carry news to some of his friends; these in turn send it on to other *yurts*. A fifty-mile ride is nothing to a Mongol. He knows that he always will find a welcome at any *yurt*. He seldom has business of such importance that it cannot wait a few days while he disperses a choice bit of gossip.

The Mongols have a direction sense which is most amazing. I often have been hunting gazelle on plains where there seemed nothing to serve as a landmark. I might drop an animal and leave it for an hour or so. With a quick glance around, my Mongol would fix the spot in his mind and dash off on a chase which might carry us back and forth toward every point of the compass. When it was time to return he would take us back unerringly to that single spot on the open plain. Of course, I learned to note the position of the sun, the character of the ground, and the direction of the wind, but only by years of training can a white man hope even to approximate the Mongols' skill. They have been born and reared upon the plains and have the inheritance of generations whose life

depended upon their ability to come and go at will. To them the hills, the sun, the grass, the sand—all have become the street signs of the desert.

The Mongol women have a great deal more independence than those of China, but share in the work of herding the stock as well as attending to the domestic duties of cooking, making cheese and butter, and caring for the *yurt*. The children, as I have remarked, are put to work almost as soon as they can walk and pursue their business of herding goats and sheep in a most serious manner. The Mongols appear to have a good deal of affection for the children and take much pride in their ability to ride, wrestle, or shoot.

The men universally use snuff. When a Mongol comes into camp or sits down beside the fire in a *yurt*, his first proceeding is to pass his snuff bottle to each person. It is exceedingly impolite to refuse to accept it, but it is not necessary actually to take the snuff. One can take the bottle in both hands, put it to one's nose, and pass it on to one's neighbor. If the visit is official, or the visitor is about to ask a favor, he usually produces a light blue strip of silk, called a *hata*, which is presented on outspread hands.

The abrupt way in which Mongols enter a tent or *yurt* is rather disconcerting at first. There is no preliminary knocking or asking permission; they simply come in and sit down. They invariably leave with the owner if he goes out. In Urga it was always difficult for foreign women to accustom themselves to this habit. A Mongol will enter a house as unceremoniously as though it were a *yurt* on the plains, and make his way about even into the bedroom without a word of warning.

When a gift is presented to a Mongol, even if he is greatly pleased with it, he simply accepts it stoically without a sign of appreciation. I have sometimes seen one put up a thumb, as do the natives all over the Orient, and say *sai* (good), but this is only when they are exceedingly pleased. Still they are not unappreciative and do have a real sense of gratitude. It is merely a custom of the country.

Until a few years ago, the Mongols remained as one of the few people of the world still living in the Middle Ages. But recent political events have conspired to impose upon them a type of civilization for which they are utterly unfitted. Their doom is sealed. The last act in the tragedy of the Mongols as a race is now being enacted.



CENTRAL ASIATIC EXPEDITION DODGE MOTOR CARS AT THE PASS IN THE GREAT WALL OF CHINA, 20 MILES FROM KALGAN, AT THE ENTRANCE TO THE MONGOLIAN PLATEAU



Returning from the Hunt

A TIGER HUNT IN NEPAL

Stalking the Big Asiatic Cat from the Back of an Elephant

By C. SUYDAM CUTTING

Trustee, American Museum of Natural History

IT may be interesting to many who have never experienced the thrill of tiger or lion shooting, to note how really great is the difference between the methods employed in the bagging of these two animals. To begin with, the tiger, which is the bigger and stronger of the two, is by far the more difficult to kill. Let us consider, in the realm of moving pictures, how rarely one sees any authentic view of a tiger in his natural habitat, as compared with the countless views of lions which already have become a drug on the film market.

Today, a green hunter in Africa rightly feels that, if he is in a proper country, with a white hunter, he should be able to get one or more lions. The great mobility of the motor car has infinitely simplified this type of hunting.

The hunter in Asia is in a very different situation indeed. He may undertake many shooting trips and never see a single tiger. The reasons for this are evident. Tigers, which appear to be much scarcer than lions and, unlike the latter, are never

seen in large numbers, are always in dense jungle or high grass. Lions, on the other hand, are usually shot in the open and even from a motor car. This is very simple compared with the elaborate preparations that must be made for a successful tiger shoot. The denseness and height of the Asiatic vegetation defies a hunter's vision, if he is stalking on foot. Views of a tiger are momentary and require a quick shot with very little time for the careful aim that one can take at a lion, and vulnerable places must be sought, such as the head, neck, heart, or spine.

Like lions, tigers when wounded are very dangerous, and a hunter on foot in the jungle, when faced by such an animal, is in a truly hazardous position. For this reason tigers are shot either from the safety of a platform, called machan, which is set in a tree about twenty or more feet above the ground, or from the back of an elephant. It is the latter method with which this article is concerned. The more elaborate way is to form a huge ring around an identified



A HUNTING CAMP

Developed during many years by the native princes of India, the sport of tiger hunting offers much that other hunting lacks. Such camps as these, with their well designed tents and many servants, provide almost every possible comfort for the hunting parties

tiger, and then slowly close in on him. The simpler way, the one by which we went about it, when on a recent expedition in the district of Kheri, was to form a drive with about a dozen elephants in line. Due to the scarcity of tigers, we did not go out for them unless we had accurate knowledge that one was present. To beat at random through the country with the mere hope of encountering a tiger, would be a hopeless proposition due to the great area of their distribution.

Our usual procedure was as follows: Each day one or more native cattle were tied up alive in the jungle. Usually, the British forest office was aware of the approximate number of tigers in the particular district we were shooting over. This information was acquired from the native forest rangers under its command, who seemed to know everything going on in the jungle. Should a tiger or leopard have made a kill, (we hunted both of these

exactly the same way) the facts were immediately reported to us the next morning by a ranger running into camp with the good news, and preparations were made forthwith for a hunt. The tiger, after killing a calf, would invariably drag it away a short distance and depart for a while, coming back later to finish his meal. During this time, however, he would surely remain in the vicinity of his kill.

There were two periods of the day when hunting was done. One was in the early morning, shortly before sun up, when there was barely light to see one's rifle sight, and continuing until shortly after sunrise. During this time the tiger was apt to be moving about in the vicinity of his kill. The other time was in the hot part of the day, when he would be lying down in some thick, densely shaded spot, and could be driven out by the line of elephants. The latter was the more popular method due

to better visibility for shooting. There was never any hurry in our start, as we knew the tiger would probably be somewhere about his kill all day.

We had twelve elephants which, when in line, gave us a beat of considerable breadth. This breadth varied so much from the nature of the terrain and the proximity of the tiger, that it was difficult to estimate its mean. Perhaps it was never less than a hundred and fifty or more than three hundred yards wide. Should a tiger, sleeping in the high grass, be startled by our beat, his tendency naturally would be to move on ahead away from us. As cases frequently have occurred where a driven tiger broke back through the line of elephants, precautions had to be taken to keep the latter sufficiently close together to frustrate such a move. Tigers, like all cats, will not run far. They also



CROSSING A STREAM DURING A DRIVE

Tiger drives are not invariably successful, for tigers are difficult to see and the terrain sometimes favors their escape



IN A HOWDAH

The elephant is controlled by the mahout seated astride the animal's neck. The hunters in the howdah are able to look out over the tall grass, but the movements of their mount make accuracy of firing somewhat difficult

have a short temper and no running endurance. One does not have to fear, while driving them, that they may disappear in the blue like deer and antelope. Of course, one may lose them, but it would then be because they had turned or doubled and were again secreted in some place where the beat would just miss them.

It must be understood that the tiger as a species was originally a cold-weather animal. The tigers of Central Asia, Manchuria, and Korea are supposed to be the progenitors of the tigers of Southern Asia. Their migration south, long ago, to the hotter climes must have been due to the vastly greater supply of game there, on which they lived.

The tigers in our area, consequently, were not amenable to great heat and, so, as soon as the sun got fairly high, they chose a densely shady place wherein to lie down. With the twelve elephants in



THE DRIVE

At the moment this photograph was taken the tiger, unknown to the hunters, was hidden in the tall grass in the extreme right foreground



A CLOSE-UP OF A HOWDAH

Photographed during a pause in the drive. The howdahs are roomy and comfortable, and the native behind finds it possible to stand on the elephant's back as he clings to the rail



BEATING FOR TIGER

The elephants are drawn up in a long line, near enough to one another to keep the tiger from breaking through. The big cats do not run far when they are approached



THE TROPHY

The natives often suffer from the depredations of the tigers, and consequently are delighted when the hunts are successful. Their flocks are not uncommonly preyed upon by "stripes"

line a considerable area could be covered, and as we continued beating so long as there was light, there was an excellent chance of coming upon one. All during the beat the line was trying to comb those places where the grass was highest and the jungle thickest.

Great excitement prevailed all the time, for at any moment someone might get a shot. We knew a bad shot might result in a charge on the elephant and possibly the mauling of him. In the presence of a tiger, an elephant will always raise his trunk and curl it over his head, for he knows how vulnerable it is to a tiger's claws. Due to the great leaping powers of the tiger, however, accidents do happen, and any wounds on an elephant's trunk must be carefully dressed.

Although we had twelve elephants, we did not have a rifle on each. Three or four rifles among the lot was a fair number, and each of the elephants carrying a rifle had a howdah. The other elephants, which merely assisted in the drive, carried one or more natives besides a mahaut. The former sat on a large pad over the elephant's back. The ropes that hold the pad in place provide something very tangible to hold on to when the going is rough. The mahaut always sits right forward of the elephant's shoulders, with one leg hanging down on each side of its neck, and all the signals, such as one would give to a horse by

the reins, he gives to the elephant by his feet.

Shooting from a pad elephant is not uncommon. The hunter, sitting directly behind the mahaut and facing due forward, has two means of traversing his

rifle right and left. For general shooting, however, the howdah is the more preferable. This is comfortably appointed, having ample space where any extra kit or guns can be placed readily at hand. Shooting from a howdah is always done standing up, and, at the actual moment of shooting, it is best for steadiness to lean against its front rail. Before any shooting is done, the elephant is always brought to a halt, but even then there is always apt



LUNCHEON *AL FRESCO*

Tiger drives often lead the parties far from camp, but the many servants make luncheons in the open pleasant breaks in the sport

to be some motion. He may suddenly shift his weight from one foot to another, and even his breathing may make the bead on the front sight a little wavy.

One morning, during our hunt, word was received that a tiger had made a kill the night before, so we started off and arrived, after an hour's beat, at a dry swamp covered with nurtle grass. This grass was so high that it completely covered all our elephants' heads. The morning was well advanced and very hot, and the grass made an excellent shelter for the tiger against the sun. As we slowly advanced, we started up numerous wild pig and hog deer that were taking their noonday sleep. Everyone was tense, those with rifles standing up, with eyes

ahead. As it happened, two tigers were lying down in this grass, and our line marched steadily on toward them. Under such conditions, when a tiger is absolutely invisible, the first news of his presence will come from the trumpeting of one or more elephants who have just winded him. Although elephants and tigers are not natural enemies and usually leave each other alone, the former, particularly females, are always afraid of tigers.

Shortly after the first trumpeting, we were able to locate our quarries. They had started slowly away from us, and their paths could be traced immediately by a movement in the grass tops. Shooting was out of the question until the tigers could be driven out of the grass and into the bordering jungle, where a proper view could be obtained. They moved forward at first in a short series of slow movements, and then one of them broke to the left and passed safely away beyond the elephant at the farther end of the line. No one saw it emerge from the grass nor did we ever see it again. We concentrated on the other. We could not tell at what moment he would emerge at the edge of the jungle, so, when he did, there was but a mere flash and the animal was gone. As we were sure he would not run far, we were confident that by persistent driving we would come up with him again.

It was slow work. The thickness of the jungle vegetation streaked with light and

shade did much to accentuate his protective coloration. Long after he had entered the jungle and shortly before the light was fading, a heavy rifle roared once and it was all over.

All during the time of the beat, the line of elephants was directed by one experienced person, Kunwar Dillipat Shah, a brother-in-law of the Maharani of the district. He was a charming Indian gentleman and our host. His method of directing was by a most efficient system of whistle and arm signals. When in the jungle, careful alignment was of most vital importance, as the elephants were frequently out of sight of one another. Any irregularity in position might afford the tiger an opportunity to break back

through our line and we not be aware of it. In the open, several manœuvres had to be made continually such as stopping, starting, wheeling, etc. Places where the vegetation was heavy always had to be crossed, as these were the most likely spots to find a tiger. There is always a limited amount of time to beat for a tiger, for it is quite possible that he may move so far from his kill that, although a great area may be covered



BATH TIME

Every morning the elephants are bathed and groomed by their attendants

by the elephants in line, the hunt must be abandoned.

It is by no means to be supposed that tiger and leopard shooting was all the hunting afforded by the type of country in which we were. These latter were merely the spectacular game animals. Many a

day would go by when, no tiger or leopard having been identified, all hands would go out on elephants to shoot anything they could get. The game here included swamp deer, black buck, chital, hog deer, sambur deer, duck, pheasant, and peacock. None of these were ever shot when we were after tiger or leopard, for at such a time any stray shot might easily startle one of the latter that might be lying down in the vicinity, and cause him to move away from us.

Our conveniences and comforts were excellent throughout. Large, firm tents, with a huge fly, were set up. One pad elephant carrying our lunch always traveled along with us. Out in the open and in the bright sun it was very hot, but, with the jungle always at hand and many clumps of trees about, one could easily find delightfully shady retreats in which to rest. Our luncheon hour was quite variable, for, should we be after tiger or leopard, we did not stop for anything until we had either gotten or irretrievably lost our quarry.

In all, on our shooting trip, we collected two tigers, two leopards, many deer, and a crocodile. Besides this, our meals were

often supplemented by game birds which we had frequent opportunities to shoot when we were crossing the big swamps on our elephants.

One last word about elephants. As domesticated animals go, they are exceptionally intelligent and appear to have really lovable dispositions. In our hunt they were so very careful of their foot work and of the ground they had to traverse, that there was no place inaccessible to them in the entire area over which we hunted. They were truly marvelous when going through thick jungle, and their great bulk apparently made little difference to them. Large, whole branches of trees would be torn away and small saplings uprooted should they happen to bar the way. Elephants require a bath once a day in order to maintain a healthy skin, and the daily bathing and scrubbing in the stream near camp was a regular ritual. They would lie down docilely and allow one of the natives to wash them all over. For whatever work they are needed, elephants cannot be too highly praised. No one who has experienced the use of them can be blind to their own peculiar charm.



Photograph by
Oscar E. Baynard



AMERICAN EGRET,
ORANGE LAKE, FLORIDA

PLAYING BIG BROTHER TO THE BIRDS

From Rock-bound Maine to Mesquite-grown Texas, the National Association of Audubon Societies Extends Protecting Arms to Its Feathered Wards

By ERNEST G. HOLT

Formerly Director of Sanctuaries, National Association of Audubon Societies

CERTAIN Jeremiahs would have us believe that Peter Minuit drove a very doubtful bargain when he paid the Redskins twenty-four dollars for Manhattan.

Be that as it may, how many of those hustling along Broadway today ever pause to consider that big buildings, big business, and ballyhoo have not always marked the course of the world's Main Street? But are not most of us prone to take the *status quo* pretty much as a matter of course, whether it be in religion, politics, or material development? This seems true even of such a relatively new thing as conservation.

Of course, it would tax even the most imaginative oldest inhabitant to recall the days when a wigwam could be found anywhere in Manhattan save the neighborhood of Union Square. Less than three decades have passed, however, since aigrettes disappeared from Fifth Avenue;

but who remembers the gorgeous head-gear of the Gay Nineties, or stops to ask what happened to it? Yet the answer to such a question is the history of one of the bitterest fights humanitarians ever waged against the greed of special interest.

It is not my purpose here to delve too deeply into that history, but I believe a few facts drawn from it would place my story in better perspective.

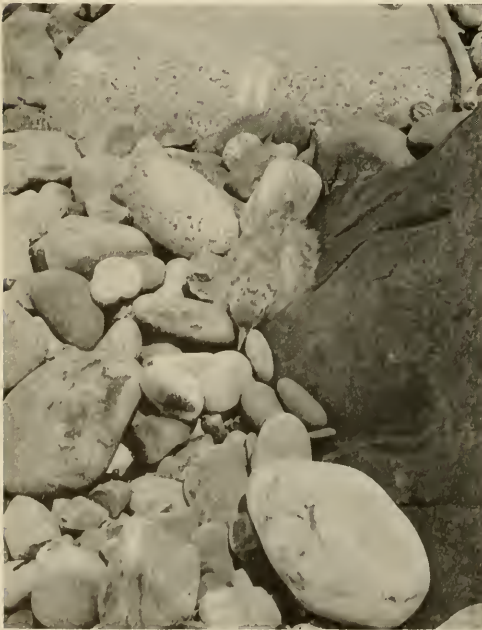
Prior to 1885 non-game bird protection simply did not exist, though protective laws had been written into some state codes as early as 1850. We have all read, of course, how schooner-loads of passenger pigeons were offered for sale in New York at one cent a bird, or fed to hogs in Massachusetts when the markets were glutted; and we all know the tragic consequence of this wanton waste. The wholesale destruction of bird life was not limited to the larger species, however. The markets of the country



Photograph by Robert P. Allen

A BIRD-MADE DESERT

Skeletons alone remain of the virgin conifers that densely clothed Old Man Island, Maine, when the cormorants sought breeding refuge here



Photograph by William Dutcher

FIND HIM!

This young tern still believes in concealing coloration

were filled with song birds, whose diminutive bodies were purchased by the housewife of those times with no more compunction than is displayed today when milady buys baked ham and dill pickles at the corner delicatessen.

But even the quest for food did not account for the most appalling of this destruction. Dame Fashion was to blame for that.

Imagine 40,000 terns killed on Cape Cod alone by one person in a single season! Cobb's Island, Virginia, witnessed a similar slaughter; while on the South Carolina coast, a three-months' trip yielded the plume-hunters more than 11,000 bird-skins. A single Long Island village, almost within sight of the metropolis, in four months supplied New York feather dealers 70,000 birds!

Upon such a troubled sea of destruction the first Audubon movement was launched in 1886—and foundered forth-

with. But the idea did not go down with the ship. Ten years later it found expression in the organization of a state Audubon society in Massachusetts. This was followed in the same year by one in Pennsylvania, and thereafter others were formed in rapid succession. In 1901 these state societies were federated—and the National Association of Audubon Societies was born.

There is no gainsaying the axiom that in union there is strength, but it must not be assumed that the new set-up found the opposition disposed to rout. Another decade was to elapse before the American traffic in wild-bird plumage could be effectively outlawed. In the greater part of the world the traffic is still legal.

Fortunately, it was realized at the outset of the new movement that laws alone could not stem the tide of destruction, and in 1900 a fund was raised by



© Photograph by Frank R. Oastler
AT OUTS

The two phases of the reddish egret on Green Island



Photograph by Ernest G. Holt

THE SOUL OF FLORIDA

It is only in the deepest swamps that one may yet find scenes such as greeted Ponce de León on his search for the fabulous fountain



Photograph by Ernest G. Holt
BACK FENCE GOSSIP
 Louisiana herons in
 their native state

Abbott H. Thayer to give concrete protection to the more important of the few remaining colonies of gulls and terns between Maine and Virginia. This was the modest beginning of the Audubon warden service, a service which today reaches from those same rocky islets of Maine to the mud flats of southernmost Texas.

How sorely it was needed may be judged from the fact that along the 1319 miles of Maine coast there were in 1900 but 28 seabird colonies, with a small population of about 9000 gulls and even fewer terns. Elsewhere on the Atlantic and Gulf Coasts butchery had produced still more alarming results.

Today, thanks to the unremitting vigilance of thirty-three years, herring gulls have increased in Maine to at least 60,000 and now breed in 77 different colonies. Terns have doubled the number

of their breeding places and quadrupled in individuals. Other birds to respond have been puffins, black guillemots, Leach's petrels, great black-backed gulls, laughing gulls, double-crested cormorants, American eiders, and great blue herons, as well as less conspicuous species. For on that "stern and rock-bound coast" no less than 39 islands are under guard by Audubon wardens—enough to give elbow room to all.

There are Maine coast islands that are green the year around with hardy spruce and fir, inviting and cheerful of aspect. Others have stood bare and bleak to the suns and storms of centuries, their naked

backs of granite bowed like old men of a more rugged age who have survived beyond their time.



(Left)
REDDISH EGRETS
 Parents and nestlings
 safe under guard

(Below)
**YOUNG ROSEATE
 SPOONBILLS**
 Big enough to do some
 foraging for themselves

© Photographs by
 Frank R. Oastler



Old Man Island exhibits a curious transition between the two. It was once verdant with a thick growth of ancient conifers, among which a few herring gulls and occasional eiders found comparative safety for raising their young. Then came the cormorants. Now we have the paradox of a bird paradise, where thousands of sea fowl flock to a bird-made desert.

The island is now but a grotesque mound bristling with the stark and broken remnants of denuded trees like a gigantic sea urchin stranded by the tide. Not a living fir or spruce remains, and, remarkable as it may seem, this startling transformation from forest primeval to sylvan graveyard was brought about in the short space of five years.

(Right)

WILDERNESS

In the Ten Thousand Islands off the coast of Southwest Florida

(Below)

THE CHALLENGE

A Florida crane disputes the right of way

*Photographs by
Ernest G. Holt*



Photograph by Ernest G. Holt

CRANE COUNTRY
The Kissimmee
Prairies of Florida



The cause, however, is obvious enough. The shags, as the Down-easters call the lugubrious cormorants, are blood cousins to the *guanay* of Peru, which Dr. Robert Cushman Murphy has called the most valuable bird in the

world. Guano is thirty-three times more potent as a fertilizer than barnyard manure; and once a conifer is chosen by a shag as a nest-site its doom is sealed.

Despite a dense human population that has made of the Connecticut coast practically a solid town from Greenwich to Stonington, a few colonies of common and roseate terns still cling tenaciously to some of the barren rocky islets along the north shore of Fisher's Island and Long Island Sounds. During the past season an Audubon warden had nine of these marine stone piles under his watchful eye, and assured breeding refuge to more than 1300 terns.



Across the sound at Oyster Bay is the Association's demonstration small-bird farm. This is a twelve-acre woodlot in which the late Theodore Roosevelt, as a boy, gleaned much of the nature lore and love that in later years made him the foremost conservationist of his time. It was deeded by Emlen Roosevelt to the Audubon Association as a perpetual bird sanctuary—a peculiarly fitting tribute to his illustrious cousin.

Skipping a new small-bird sanctuary on Staten Island, we come next to Cobb's Island, Virginia. As an Audubon refuge, it, like some of the Maine islands, dates back to the turn of the century; but here all similarity ends. The sheer bluffs of granite have given way to wide beaches of shimmering sand, the stately conifers to marsh grasses, the boreal gulls and shags to birds of warmer clime.

On the beaches black skimmers, like

avian caricatures, lay their eggs in shallow depressions, with dainty least terns for neighbors, while willets and oyster-catchers patrol the strand. In the landward marshes large numbers of laughing gulls, Forster's terns, and clapper rails build their nests among the grasses and sedges.

Yet, the birds here have hardly more than held their own. Two extirpated species, the Caspian and the royal tern, have never regained a foothold; and it seems probable that this region will not again teem with the bird-life it knew before the coming of the egger and the plume-hunter, for the main factor which now inhibits the increase of the birds is beyond human control.

The history of this ornithologically famous region is literally a stormy one. Gale-driven seas have taken two miles from the island's length and much from



Photograph by Byron

THE EVERGLADES AS OF OLD

Before the misguided efforts of real estate operators to convert the whole of southern Florida into towns and farmsteads, the Everglades swarmed with birds. Consider the results shown on the opposite page

*Photograph by Byron*

THE MARCH OF CIVILIZATION

With the artificial draining of the Everglades, the muck—there is no true soil—becomes as tinder during times of drought. Then comes the Destroyer. Thousands of herons and ibises are here perishing in the flames leaping from their rookery

its breadth since "Old Nathan" Cobb settled his belongings and his name on the sand-spit nearly a hundred years ago. Last season a storm swept the area at the height of the breeding season. When it subsided, the birds patiently built new nests and laid more eggs, only to be overtaken by fresh disaster. On August 23 a still more violent storm, in which the warden himself was lost, swept the island clean.

This tragedy adds yet another name to the steadily mounting roster of those who have given their lives in the service of the birds.

At Beaufort, North Carolina, we find the northernmost of the Association's egret colonies. Here small numbers of both American and snowy egrets, in company with Louisiana, little blue, and black-crowned night herons, nest deep in a dense thicket of myrtle. An interesting

spectacle, but hardly even a foretaste of what is to come, so let us hurry along without stopping to examine two similar colonies near Charleston, and another near Savannah.

In the lowlands of the Georgia coast the big brother idea finds a slightly different expression. Three great rivers—the Savannah, the Ogeechee, and the Altamaha—meander leisurely through swamps of cypress and gum that have played an important rôle in checking the sad retreat of the wood duck. These ducks, unlike most of their fellows, deposit their eggs in the hollows of trees. Obviously, then, they are not gregarious, and present a problem in their protection different from that of the colonial nesters we have been considering. The warden here must be highly mobile, and the protection he metes his wards is measured in gallons of gasoline.



Photograph by Ernest G. Holt

FLOATING CAMP

Because of frequent shifts from place to place and the almost total absence of dry land, the Ten Thousand Islands wardens live on a houseboat

easily accessible and has been described in print so many times that I hesitate to add another description here. It is the breeding place of hundreds of American and snowy egrets, Louisiana and little blue herons, water turkeys and

Now we cross the line into Florida—palm-wreathed realm of fins, feathers, and fantasies. Born of a mad quest for a fountain of youth, it seems about to expire from over-reaching after the equally illusory chimera of inflated fortunes. So much for the fantasies.

As for the fins, suffice it to say that 3750 miles of coast line, 30,000 lakes, and countless streams make of Florida the supreme Elysium of those who worship at Ike Walton's shrine.

By the same token, Florida was once a paradise for birds, especially for the long-legged sorts that wade for a living. Then for a time it became a bird purgatory. At this juncture the Association stepped in and put a warden at Cape Sable. Plume-hunters killed him, but other wardens have carried on his work.

There is hardly a part of the Everglade State that has not at one time or another been an Audubon battle ground, though the actual swapping of hot lead has always been confined to the lower Florida wilds. Even now, after thirty-two years, there is an element in south Florida not at all averse to taking pot shots at wardens.

In north-central Florida the Association has owned a marshy island in Orange Lake since 1910. This is probably the best known heronry in the state, for it is

white ibises; and is one of the few places in Florida where the glossy ibis is known to nest. And for every one of these creatures there is a sable shadow—a fish crow.

Attractive though Bird Island manifestly is to its feathered throngs, it is not without unpleasant features for humans.



Photograph by Ernest G. Holt

IN THE ATCHAFALAYA SWAMPS

Here the largest known colony of yellow-crowned night herons was recently placed under guard

Photograph by Ernest G. Holt

RAINEY HEADQUARTERS

The size and importance of the Rainey Sanctuary in southern Louisiana warrant the maintenance of permanent headquarters and a resident superintendent



When I stepped ashore from the warden's boat one day last June into the dense jungle of careless weed, pokeberry, elder, and dock, gathering storm clouds blotted out the sun. Save for this circumstance alone we would have parboiled in our own sweat, for in that rank growth of weeds no breath gives respite from a summer sun. Shod in canvas tennis shoes, I had gone scarce a dozen yards when I almost trod on one of the fattest, blackest water moccasins I have ever seen. A few more paces and I narrowly missed

treading on another. Then another and another and another, all of enormous size. After routing the fifth hideous reptile from our path we decided we had seen enough.

But, at that, the decision was too long delayed. That night I found myself host to a horde of chiggers, and I literally swarmed with mites that had abandoned the nestling birds for a bigger proposition. The implied compliment was not appreciated!

For seventy-five miles along the southwestern coast of the peninsula, from Big Marco Pass to Cape Sable, lies perhaps the least spoiled wilderness remaining in the United States today. This is the region known as The Ten Thousand Islands, though examination of an aerial map would lead one to suppose that a cipher has been omitted from the estimate. It is an enormous mangrove swamp, flanked on the one side by the Everglades, pounded on the other by the Gulf of Mexico, and dissected by countless channels that form a labyrinth negotiable by few even of the natives. There is hardly any dry land at high tide—just a world of crisscrossed roots from which the smooth boles rise like the rod from the ribs of an umbrella blown wrong side out. The mangroves here attain a size greater than anywhere else in the world.



Photograph by Ernest G. Holt

BANDING DUCKS ON RAINEY SANCTUARY

Tens of thousands of ducks and geese winter in these lakes and marsh lands



Photograph by Ernest G. Holt

WHITE BIRDS AND BLACK

Wood ibises and water turkeys nesting together in a corner of Lane River rookery

Always good bird country, this region has now become the scene of incredible concentrations. Successive droughts, following upon artificial drainage, have so scourged the Everglades that practically all of the waders have been driven from these former happy fishing grounds into the coastal swamps. As a result the Audubon wardens during the past season

have had the care of two rookeries probably surpassing in population any recorded in ornithological literature. At Lane River the wardens reported 50,000 breeding wood ibises, 40,000 Louisiana herons, 40,000 snowy egrets, 15,000 American egrets; and so on through the whole gamut. The birds occupied about thirty acres of mangrove islets.

On Shark River the wardens threw restraint to the winds and turned in an estimate that looks more like Gotham's deficit than anything pertaining to birds. Picture 250,000 white ibises if you can! Yet I found fifteen acres of vegetation trampled flat by the young.

Such tremendous concentrations render the birds at once easier of protection and more vulnerable to disaster. There is a certain type of Key West fisherman, known locally as a "conch," always alert for the opportunity to vary his diet of fish with a little fowl. The kind of fowl is not of great importance, but the favorite seems to be the fat young of the white ibis. The "conchs" have been known to clean out an ibis rookery and salt the birds down in barrels. Moreover, these fellows are still able to find a market for aigrettes



Photograph by Ernest G. Holt

WINGED CLOUDS THAT ROAR AS A STORM

A small portion of a flock of about 15,000 blue geese rising from their feeding ground on the Rainey Sanctuary



Photograph by Robert P. Allen

WHERE LIFE IS A SERIOUS BUSINESS

These cormorants of the Maine coast are solemn birds, songless and funereal even at nesting time

by smuggling them over to Cuba or the Bahamas, whence they are shipped to the fashion centers of Europe.

And here again it is not alone a human hazard with which the birds must contend. At Lane River last May the ground was strewn with the bodies of fledgling Louisiana herons, American and snowy egrets, and even the tough wood ibises; while other dead lay in the nests. So great was the mortality that the assembled vultures were overwhelmed. Yet there was no evidence of violence, and I was finally driven to conclude that the birds were being killed by mosquitoes. In fact, I had very personal reasons for so believing.

Though I wore gloves and head-net, every photograph cost its weight in blood, for the fierce creatures found no difficulty in piercing my shirt. When we sought respite by pulling our boat out into the open water, they followed in swarms, intent upon a ration of blood even under the scorching midday sun.

After the breeding season the birds abandon the mosquito-infested interior regions and congregate in enormous roosts on the outer keys. One of the most no-

table of these is at Buzzard Key, another at Duck Rock.

The birds had barely begun to assemble when, on May 14, I visited Buzzard Key, yet there were thousands upon thousands of ibises, egrets, and herons settling down for the night in the mangroves, to the accompaniment of a terrific din of babble and squawk. After the sun



Photograph by Ernest G. Holt

A WONDERFUL BIRD

Pelicans are grotesque even in babyhood. Thousands are yearly protected by wardens

had set, I struck the deck several sharp blows to simulate shots. Instantly there surged up from the trees a white cloud of beating wings that filled the sky. The report of a gun is not just another noise to these birds.

A storm warning is coming in on the wardens' radio, so let us leave the boys to tow their houseboat to a safer mooring among the mangroves, while we hop across the Gulf to the delta of the Mississippi.

At the mouth of Pass A'Loutre the stresses and strains resulting from Old Man River's deposition of millions of tons of silt have spewed up a series of little mud islets. Evanescent, here today, tomorrow disappeared beneath the muddy waters whence they came, these islands find no place in human economy. But to thousands of brown pelicans they are a refuge and a mountain of strength. Free from molestation save by the storms that

lash this coast, the birds return season after season to rear their young under the care of an Audubon warden.

Now let us follow the track of the westing sun. On the farther side of Vermilion Bay we come to the Association's premier sanctuary—26,000 acres of lakes and marshland donated by Mrs. Grace Rainey Rogers, as a memorial refuge for the wild fowl that held such a strong appeal for her brother, the late Paul J. Rainey. Ducks and geese winter here by tens of thousands, and as many as 50,000 blue geese, including the usual sprinkling of snow geese, have fed on the refuge at one time.

Time will not permit us to visit the largest known colony of yellow-crowned night herons, recently brought under guard in the Atchafalaya swamps, nor the only known colony of roseate spoonbills in Louisiana, guarded for years in Cameron Parish. On the door-step of



Photograph by Oscar E. Baynard

STRANGE CREATURES OF MARSH AND SWAMP FIND A SAFE RETREAT

Hundreds of white ibises and Louisiana herons, together with other waders, rear their young in security on Bird Island, in Orange Lake, Florida



Photograph by Ernest G. Holt

YOUNG WHITE IBISES ON SHARK RIVER

The wardens estimated that at least 250,000 white ibises find refuge along Shark River

Galveston another spoonbill colony has been given warden protection, but let us speed on southward.

Across the vast shallow expanse of Laguna Madre a shapeless blurr in the mirage gradually takes form. Drawing nearer, we see that it is an island; not a bare spit of sand or bar of shell, but an island raised several feet above the surrounding shoals. Its surface is lush and green, but be not deceived. This soft green may be balm to the eye wearied by the glare of glassy water and barren sand, but it is literally thorn to the flesh. Cactus, mesquite, cat-claw, yucca—every leaf hides a thorn or is itself a spine. Yet Green Island is a haven for birds and its impenetrable jungle their salvation.

We go ashore where a few piles indicate that a pier once stood, and follow a narrow path through the tangle that clutches at our clothing, loath to let us pass. Before us stands a cabin minus

most of its roof; at one side sprawls an up-rooted observation tower. We look at the warden, but he merely shrugs. Doesn't he have to put a new roof on that cabin every blessed year? And what is one tower, more or less, when practically his whole home town has been blown away?

What of the birds? It is fatuous, of course, to believe they escaped unscathed. During the past season they were struck on August 4 by "the worst hurricane since 1886," and on September 4 by "the worst in sixty years." Fortunately the birds have learned to "dig in" in that vile tangle of thorns, for though the waves pound away great chunks of the island, no wind can budge the matted vegetation. The largest colony of reddish egrets in the United States, therefore, can look forward to yet another season on Green Island.

Prolix though I have been, I have given



Photograph by Ernest G. Holt

BROWN PELICANS ON THE PASS A'LOUTRE MUD LUMPS

Part of the great colony of pelicans that nest free from molestation at the mouth of Pass A'Loutre

but an outline of the Association's efforts to extend concrete protection to birds, for during 1933 there were 31 different bird refuges under its administration. As we have seen, these extend from easternmost Maine to the southern tip of Florida and thence along the Gulf coast almost to the Mexican border—more than eighteen degrees of latitude and thirty degrees of longitude.

Only a generation has passed since the idea of setting aside an area of land as sacred to the uses of a group of birds was first put into prac-

tice, yet it is now so firmly established that "sanctuary" has become a more familiar word outside the church whence it was borrowed than in.

The Association can justly take pride in its part in this development. During all those years when we used to hear so much about our duty to "little brown brothers" of far-away isles we did not even know where to find on the map, the Association was striving to

apply the same principle of fair play to our little feathered brothers right here at home. It has not striven in vain.



A MAINE COAST PUFFIN
Photograph by William Vogt



GREEN ISLAND, TEXAS. FROM A PHOTOGRAPH BY ALDEN H. HADLEY



General View of Darwin's Old Study

DOWN HOUSE—DARWIN'S HOME

Intimate Glimpses of the Scientific Shrine, Now Restored and Open to the Public,
Where Charles Robert Darwin Wrote *The Origin of Species*

By BENJAMIN SPECTOR

Professor of Anatomy, Tufts College Medical School, Boston, Mass.

Foreword.—Sir Buckston Browne, F.R.C.S., LL.D., was born 1850, the son of a physician. He attended University College, London, and was awarded medals in Anatomy, Chemistry, Midwifery, and the Liston gold medal in Surgery. As a distinguished surgeon, he contributed important articles to the literature of his profession, including the Harveian Lectures of 1901. Through his generosity and far vision Down House was purchased, restored, and opened to the public on June 7, 1929. It has now become the recognized repository of Darwiniana and, by his establishment of a surgical research station adjoining the land of Down House, Sir Buckston Browne has re-established the scientific tradition of Downe, Kent, England.

THE thought and work of Charles Darwin are now the intellectual heritage of every educated person. Students engaged in the study of the phenomena of life and of the various adaptations of living in all parts of the earth find a common camping ground in the contributions made by Darwin. Readers of NATURAL HISTORY will therefore find it fascinating and stimulating to examine carefully the "old study" in which Darwin wrote his immortal *The Origin of Species*. The accompanying photographs were taken while the writer

was in London during the summer of 1932, and he takes this opportunity to express his warm thanks to Sir Buckston Browne, the honorary curator and donor of Down House, for the privilege of studying at first hand various articles in Darwin's home; to Professor Sir Arthur Keith, conservator of the Hunterian Museum, for his kindly encouragement; and to Mr. L. W. G. Malcolm, conservator of the Wellcome Historical Medical Museum, through whose interest and kindness these photographs were taken.

The life of Charles Darwin falls into



THE NORTH WALL IN DARWIN'S STUDY

Darwin's iron-framed armchair in which he wrote *The Origin of Species* stands in the foreground. His cloth-covered writing board spans the arms, and a nest of drawers for filing notes concerning this famous work is in the recess at the right



THE EAST WALL

The low seat used by Darwin when at work with the microscope fits under the window shelf, and a mahogany table with circular revolving top and drawers occupies the pier between the windows within easy reach of both chairs



THE SOUTH WALL

In 1931, Dr. C. A. Seward, professor of botany in the University of Cambridge, decided to lend to Downe House the major part of the Darwin Library, which was bequeathed by Sir Francis Darwin to the professor of botany in that University



THE WEST WALL

On the wall are framed maps showing Darwin's own markings and notes in connection with his work on coral reefs. An armchair that belonged to Dr. R. W. Darwin and a terrestrial globe and table are grouped close at hand

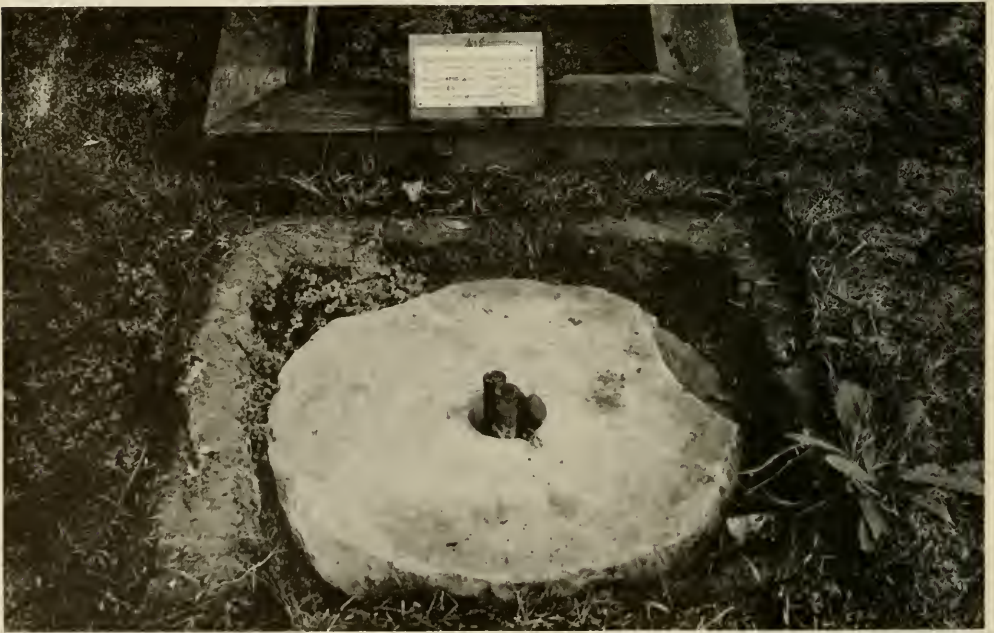


THE WINDOW BENCH

A detailed study of the corner by the window where Darwin worked with his microscope

three clearly defined periods. The first period dates from February 12, 1809,

the year of his birth, to 1831, the year in which he set sail as naturalist on H. M. S. "Beagle." Darwin's father, Robert Waring, and his grandfather, Erasmus, were both naturalists and physicians, and from both of them he inherited his marked taste for natural history. During this first period he spent two years at Edinburgh University studying medicine and three years at Christ's College, Cambridge, studying for the Church. The second period begins with the voyage of the "Beagle" on December 27, 1831, and ends with his return to London in 1836. These five years determined his whole career. The third period may be dated from the year 1842, at which time he settled in his house in Downe, County of Kent, and lasted to the time of his death, April 19, 1882. It was in this third period of his life that he wrote *The Origin of Species*, *The Descent of Man*, *The Expression of Emotions in Man and in Animals*, and his other publications.



WHERE DARWIN STUDIED EARTHWORMS

The inscription above the circular stone reads: "Observations on the level of this stone were used by Darwin and his son Horace Darwin in their investigations of the action of earthworms (1877 seq.)"



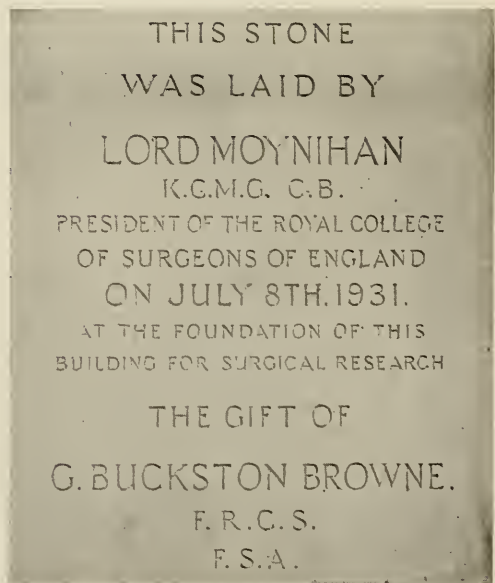
THE BUCKSTON BROWNE SURGICAL RESEARCH STATION

The gift of Sir Buckston Browne. It adjoins the land of Down House and will carry on the scientific tradition of Downe. A statue of Saint Francis of Assisi stands in the niche above the entrance to the building

It is beyond the purpose of this article to review the scientific achievements of Darwin or to discuss in detail the precursors in the development of the idea of evolution up to the time when Darwin "fired the shot which was heard 'round the world." Rather would we give free play to our imagination to the end that we may picture an English gentleman—whose qualities of goodness, kindness, and truthfulness strike deep in his spiritual nature—walking about a room as pictured here, discharging cerebral energy, destined to change the climate of opinion of anything that had gone before.

Since the beginning of time man has tried to solve the problem of Man. Attempts to find a unifying factor amidst the variety of life have become the province in turn of theology, philosophy, poetry, and science. Darwin dealt with each one of these at varying times. It is not difficult to look at these photographs and imagine Darwin seated in his chair, pondering over the first chapter of

Genesis, B.C. 4004, with its suggestive stages of evolution through means of



CORNER STONE, SURGICAL RESEARCH STATION

The Buckston Browne Research Farm, comprising a large house and laboratories, was presented to the Royal College of Surgeons of England



ON THE PORCH AT DOWNE HOUSE

An interesting photograph of Sir Buckston Browne (left), the donor of Downe House and the Surgical Research Station, and of Professor Sir Arthur Keith, who is seated in Darwin's chair

special creation. Following up this idea, it is interesting to speculate what Darwin must have thought as he read Book V of *The Nature of Things* by Lucretius, the Roman poet, B.C. 98-55; for, although Lucretius places the mechanical above the teleological conception of nature, he continues to write:

Wherefor, again, again, how merited
Is that adopted name of earth—the mother
Since she herself begat the human race
And at one well-nigh fixed time brought forth
Each beast that ranges raving round about
Upon the mighty mountains and all birds
Aerial with many a varied shape.
. . . but each soul thing
Proceeds according to its proper wont
And all conserve their own distinction based
In nature's fixed decree.

We should not forget that the poets played a fairly considerable part in enunciating evolutionary thoughts before and at the time that Darwin began to consider them, and therefore it is well to take note

of them. Let us refer to one other poet, another son of Christ's College in Cambridge, whose epic of Special Creation, *Paradise Lost*, served to shape the thinking of his day. In Book VII of Milton's *Paradise Lost* we read:

Let the earth bring forth soul living in her kind,
Cattle, and creeping things, and beast of the
Earth,
Each in their kind! The Earth obeyed and
straight,
Opening her fertile womb, teemed at a birth
Innumerable living creatures, perfect forms
Limbed and full-grown. Out of the ground
uprose
As from his lair, the wild beast, where he wons
In forest wild, in thicket, brake or den.

Vital passages from Tennyson's *In Memoriam* and Browning's *Paracelsus* might be quoted, but we must on to some philosophical considerations.

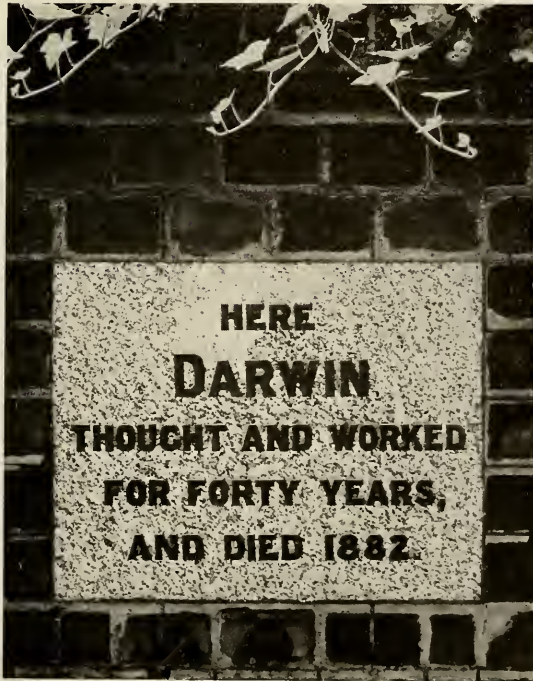
The Aristotelian (B.C. 384-322) idea that man is the highest point of one long and continuous ascent, and Leibnitz'

(1646–1716) enunciation that “All natural orders of being present but a single chain, in which the different classes of animals, like so many rings, are so closely united that it is not possible either by observation or imagination to determine where one ends or begins,” focussed Darwin's thinking on the scientific level of this problem. For a full and thrilling story about these matters one must read *From the Greeks to Darwin* by Professor Henry Fairfield Osborn.

One should not leave the consideration of these photographs without recalling the magnanimous attitude that Darwin assumed toward his critics. Here, if any-

where, was a man who could be stamped as the proud possessor of that rare quality, equanimity. One searches without avail to find a single instance of truculence; his calm and benevolent manner amidst violent opposition bespeaks his reverent nature. To the writer it is of the utmost importance to view the photographs accompanying this article with these characteristics in mind, in order that sentiment and science may be kept together.

It is indeed with a sense of having made a pilgrimage that one leaves Darwin's home, a shrine of a new dawn of righteousness, beauty, and truth.



THE PLAQUE ON THE WALL NEAR THE GATE LEADING TO
DOWNE HOUSE



Head of an African Buffalo. Mounted by Robert H. Rockwell

ON THE TRAIL OF THE AFRICAN BUFFALO

Adventure in the Tall Grasses and Swamps of Africa

By ROBERT H. ROCKWELL

Taxidermist, Department of Preparation, American Museum

MY opportunity to study and hunt buffalo came through the late Carl E. Akeley on his last expedition in 1927. His plans called for a group of these animals to be included in the Akeley African Hall of the American Museum of Natural History. The hunt began at the Tinga Tinga swamp near a place called Kageo about sixty-five miles north of Nairobi. This swamp comprised an area of about one hundred acres, densely overgrown with twelve-foot reeds and soft waist-deep gumbo mud impossible to hunt in but a secure haven of refuge for a herd of about thirty buffaloes. Due to persistent shooting and on account of their close proximity to a motor road that was only three hours distant from Nairobi, this herd had become exceedingly shy, and, as we discovered, decidedly nocturnal in their habits. All the time we remained there, they never left the swamp in the daytime, and it was only after staying out all night on a platform built on the

intricate branches of a large tree that I saw them at all. From this hiding place I finally did get a chance to observe them early one morning in their more peaceful moments.

With the aid of strong binoculars I saw the herd at sunrise as they moved in my direction through the tall grass. Even then only the tops of their black bodies could be seen amid the dense papyrus, but their presence was always indicated by a flock of white herons that were continuously flying over them and alighting on their backs. Fortunately they moved up quite close to my position and, being completely unaware of my presence, advanced through the swamp toward a small grass-covered island thirty yards away from my high but hidden perch. It was a thrilling sight when an old bull raised his huge bulk on to this cleared dry ground. Others soon followed him, and as he came to the center of the knoll, he stood, looked around, and uttered low,

rumbling grunts. This may have meant that everything was all right. Then, as his family came up around him, an old cow lay down contentedly and began chewing her cud. In the meantime at least thirty white herons stood around and often perched on the broad backs of the buffaloes, preening their feathers leisurely or standing close by in little groups all hunched up in perfect repose. At the time I thought "What a setting for a museum group!" From the spell of this happy moment ideas developed, but I lost my first chance to obtain a real fine buffalo bull.

There had been several opportunities to shoot, but charmed by the scene, I had waited too long; the herd suddenly became alarmed, milled around for a brief moment, and then vanished into the fastness of the swamp.

Following this episode all our efforts seemed to be doomed to failure. The buffaloes were there and I presume they knew that we were there, too. Anyway,

they were safe and well protected; with twelve feet of green fodder above them and a hundred acres of mud bath to wallow in, they could hold out indefinitely. So we gave up and started looking for other buffaloes that had not learned so well how to take care of themselves.

Akeley had an idea that there might be larger herds down on the Tana River. In fact, he hoped we would rediscover surviving descendants of a herd of several hundred that he had seen and photographed in the open twenty years ago. This plan was basing a lot on luck, but all hunting has plenty of this element, which makes it essentially more interesting.

Leaving our main camp at dawn, Akeley and I, with four native helpers and two motor trucks, proceeded southeast cross country and toward the Tana River. There were no roads, so our course led over very rugged, bumpy ground and through vast valleys of rich grass that stood well over the hoods of our cars. Except for herds of hartebeest and zebra,



Photograph by Martin Johnson

AN AFRICAN BUFFALO ON THE ALERT

Among hoofed animals, perhaps none excels the courage and gameness of the buffalo. His great strength enables him to charge through the deepest swamps and tangled undergrowths with the speed and spirit of a Spanish fighting bull



Photograph by R. H. Rockwell

THE TANA RIVER FROM THE NORTH BANK

It was along the Tana River that several of the animals for the American Museum buffalo group were collected. Buffalo are seldom seen far from water

we saw scarcely any game on the way. But birds were exceedingly plentiful. Doves fluttered all over the landscape. There seemed to be no end to their numbers. As we passed along, we could see at least a few on every branch and tree. As we advanced, slate-colored hawks wheeled in the air and circled over our cars, frequently snatching unwary quail that flushed from cover right in front of our eyes.

We continued by car over this country, exploring for two days. Akeley pointed out the range where he had formerly found his big herd, but the search showed us nothing of buffaloes except the signs of a few tracks on the brink of a stagnant pool.

We returned to our base camp rather discouraged, and on the following morning Akeley left me there. He was always restless to go on. An irresistible urge seemed to be driving him to the Congo. However, before leaving, he gave me instructions to proceed down the Tana

again and, if possible, find the big herd and try to obtain a series of animals for the buffalo group.

On that same day I packed a supply of provisions on the truck and, with four black men as helpers, traveled south again, and finally camped on an extensive plain near a water hole, only a few miles from the Tana. Accidentally we met some native Wanderobo hunters who assured us that they had seen many buffaloes, and, in proof, showed us their fresh tracks. We felt happier now.

It was a pleasant experience hunting and tracking with these half-wild black men, but it meant being on the go from dawn until dusk under a blazing tropical sun. Finally, after four uneventful days, as we were plodding back to camp late in the afternoon, my gun bearer, who spoke English only a little, gazed for a long time at one spot and then said suddenly, "I see it." Looking through my field glasses, I saw "it," too,—a big herd of buffaloes grazing quietly, just as they

appeared in Akeley's wonderful photograph snapped almost twenty years ago. My guide and I counted them three times and, as near we as could figure, there were two hundred and fifty in the herd. It was like looking at a great picture but much more thrilling. I only wished Akeley could have been there.

It was now late in the day, the light was fading, and, considering the work involved, I decided to leave them just as we found them, hoping that they would remain until morning. The camp was in high spirits that night and we hopefully waited for daylight.

I was up while it was still dark and we were soon on our way. The herd had moved only a short distance, but on account of the lack of cover, it was well nigh impossible for us to make a stalk without being seen. At last we decided

to take up a favorable position in what we figured was their line of travel to water, and wait.

We were always far enough off so it was easy to change our position as they advanced. We had fooled around them nearly all day, waiting and watching, retreating and advancing, when presently the trek began toward water and the herd appeared in open formation advancing directly toward us. On they came, slowly but with caution, led and guided by a vigilant old cow. Muleim, my gun bearer, stood beside me. The animals were now almost within range, and we were trying to estimate which carried the best pair of horns. Suddenly the old cow leading them stood still as she topped the brow of a hill. She was not looking at us but gazed steadily beyond and to the left of us. Something was there that did



Courtesy of James L. Clark

From a Painting by Arthur A. Jansson

DANGER IN THE WIND

To happen upon a herd of buffalo in the open and see them all swing about and face up wind is an unforgettable experience. The bulls with their massive curved horns present an unbroken front line, the cows and calves in the rear, all with heads held high, with moist nostrils sniffing for a scent of danger

not look right to her and the whole herd stood awaiting her decision. From our cover we looked back toward our car and camp that nestled under an acacia tree. It was more than a half mile away. Here some of the boys who had been left in camp had climbed on top of the car in order to see the show.

We hardly had time to decide what happened when the old cow gave a warning bellow and the whole herd cleared out of sight, enveloped in a dense cloud of dust.

There was nothing to do but return to camp. Perhaps anger is not the word properly to describe my feelings. After weeks of patient effort the game had been almost within our grasp and now we had lost it on account of these simple-minded porters. The camp had been in such high spirits the night before. Now it was just the reverse. Nevertheless, exhaustion lulled us to sleep.

Finding fresh tracks the next day, we took up the trail with renewed vigor and better humor. Having frightened the herd, we found hunting from now on even more difficult, developing into all-day tracking trips. But not many days later we trailed the herd again. They had been in a dense thicket. It was early morning and their tracks had worn a deep

path overland. They must have walked in single file; the fresh mud flung from their cloven hoofs still clung to the grass beside the trail. This group entered an extensive swamp where it would have been hopeless to follow. We knew they were there, for presently a flock of tick birds flew into a tree, chattering loudly. Then, from our vantage point, we saw the dark bodies of buffaloes moving off into deeper cover. Again we felt defeated, but later in the afternoon, as we crossed a low series of hills along the Tana, we made contact with them again. While using the glasses, I picked up a small group of buffaloes moving along a wide valley more than a mile away. They were in full retreat, no doubt from the same herd we had started in the morning and, as I watched them, small bands followed the first group at intervals of from five to ten minutes. They all seemed to be in a great hurry, the leader of each troupe scenting those that had gone on, with his nose close to the ground like a hound following a trail. It was fascinating to watch. Each group that passed I thought would be the last, but on they came at short intervals in bands of four or five and often more. I decided if they continued coming, there might be others far in the rear that I could inter-

cept, so I ran for all I was worth, arriving at the line of march just as five rushed past. I posted myself in an advantageous position and waited for more. Within

THE END OF THE HUNT

The night the buffalo was shot, camp was made here in the open, to guard the prize from marauding hyenas. At this place after dark, lions roared unpleasantly close at hand and, fearing that they might make an attack, the men kept fires going all night



Photograph by R. H. Rockwell

THE DONGA IS BLOCKED

On dissecting the animal, it was noted that the ribs were extraordinarily wide, some of them measuring over four inches across. Subsequent comparison proved that they were wider than the ribs in any other African animal

Photograph by R. H. Rockwell



five minutes another herd following in the same trail offered an easy shot and I secured an adult cow and a brownish-colored calf. These were exactly what

Mr. Akeley wanted for the group, so, with my helpers, I began to prepare the specimens at once, and by working most of the night, saved the two skins.

Akeley had told me to look for an old bull, a solitary old bull, preferably with horns spreading over at least forty inches. This was a big order and we hunted steadily for the best part of a week and spied from the hills with the glasses for hours until our eyes burned from the strain. The quest seemed nearly hopeless, but we had to have that old bull, and although our provisions were running low, there was always fresh meat and smaller game on which we could live. In hunting, as in other fields of endeavor, success is often just around the corner or beyond the top of the next hill. Sometimes it comes by a last look through the glasses at the end of the day or just as the shadows deepen and one stumbles homeward exhausted within sight of the camp.

My last day on the Tana was not unlike many other days that preceded it, but it furnished an episode that might be worth recalling, as it may give a clearer picture of what confronts the taxidermist while collecting some of the animals for a museum group.

We had been trailing and tracking nearly all day and nothing of particular

interest had developed until around four o'clock. We were far from camp and the black boys began to show apprehension lest we find ourselves unable to reach it by nightfall. Consulting with Muleim, I asked him what he thought. His reply was, "Bwana, let us keep on until we get to the top of this little hill."

The advice appealed to me. I always like to look beyond the tops of hills. We therefore kept on and soon arrived there. Muleim looked over the broad, grassy plains and said nothing. The others stood beside us probably hoping we would turn back. As I moved the glasses on a shallow valley about three hundred yards distant, I was astonished to see a splendid buffalo standing close to a dwarfed acacia bush on the farther bank of a dry river bed. He seemed so large and massive through the lenses that I almost doubted my vision, and, thinking the heat had affected me, I looked for him again with unaided eye. Then the vision merged into reality and as I motioned to Muleim we all dropped down in the grass.

While the guide and I discussed a plan of approach, the buffalo lay down, but we could still see part of his head facing in our direction. The position we had on the hillside was quite exposed, but we kept well out of sight screened by the grass



Photograph by R. H. Rockwell

THE CAMP IN THE BUFFALO COUNTRY

Buffaloes used to roam over a much larger territory than that which they inhabit today, and even though the advance of civilization has driven them from many of their favorite haunts, they are still found in reasonably large herds both north and south of the equator. It is reported by reliable authorities that in Kenya buffalo are actually increasing in numbers

from the watchful eyes of our quarry. The stalk necessitated crawling nearly three hundred yards, and, as the grass was short, I had to worm my way through it, pushing the rifle ahead. In doing this a dry, round reed slid down the muzzle and broke off. This made it imperative for me to find another reed, straight and of the same caliber, to push the broken one out. Had I not noticed this and found a remedy, the gun when fired might have exploded in my hands. It held me up some time, but the reed was expelled and I crawled on and reached the sandy donga as the sun sank on the horizon. Once I had gained the top of the high bank and reached level ground I felt that I must be somewhere near the quarry, so I gave a loud whistle. Instantly the buffalo arose from the grass and stood staring at me only thirty yards away. As I fired, another buffalo bounded out of the bush, and both ran off apparently none the worse for several shots fired as they disappeared down the donga. Muleim, who had been on the hill watching all that had

happened, came over and offered words of encouragement which were badly needed.

"Bwana, I think you hit first time. Big bull hold his head very low when he run."

We wandered on together along the bank of this parched river, and had walked only a very short distance when he turned to me with a happy smile, shook my hand and exclaimed, "There's your buffalo, Bwana."

At first I thought he was fooling. As I looked closer, a black object camouflaged with sun-baked mud was all that I could see. Then his full outline became more definitely defined. We were now quite close. The huge beast made a move toward us, and not wishing to prolong an unpleasant climax, I fired two more shots which ended the hunt.

By this time the sun had set and, if we had left our prize all night, hyenas would have made off with most of it, so we planned to stay right there and sleep in the open.

There was much work to be done; but

saving this valuable specimen meant everything. The little food and water that we carried with us had long ago been consumed. We could live on the buffalo of course, but we could not work without water, and as there was no water anywhere in evidence on this parched plain, Muleim suggested that he take the boys, follow the dried-up river bed and, by digging in the sand, perhaps find a seepage or enough to tide us over this thirsty spell. Without water our prize would have to be abandoned and our efforts prove futile. All the boys were very thirsty, so they went with the guide. I remained and made some measurements of the specimen in the gathering dusk. Then, as it became darker, I moved up to a slight rise and sat down just above the kill, hoping that my companions would soon return. I remained there in the gloomy darkness for nearly an hour

pondering over the exciting events that had just terminated, when suddenly two lions roared unpleasantly close. Their voices were so distinct that I judged they were not more than a hundred yards away. It was a moment of extreme apprehension. The thought ran through my mind, now, that *I* was being hunted, and, to say the least, I felt very unhappy. There were no trees to climb, no rocks to hide among, absolutely no possibility of security on this dark, open plain, only a sincere hope that these marauding lions would not find me. I was aware that lions seldom approach a fire, but there was no wood to start one. So I set fire to the grass as they continued to answer one another in low grunts from the hillside. My fire flared up hopefully at first and then died out where the grass became thin. For more than half an hour I kept gathering dry grass to keep this doubtful



THE NEARLY COMPLETED AFRICAN BUFFALO GROUP

The background painting shows snow-capped Mount Kenya, and in the foreground the natural habitat designated by Carl Akeley as typical buffalo country. It was largely due to Mr. Daniel Pomeroy's interest in the buffalo group that the work was carried on after Mr. Akeley's death. He collected and contributed specimens, making extended trips into remote regions in order that representative animals might be obtained

beacon burning. At last the lions ceased roaring, and later, the ominous silence was broken by the voices of the guide and his men heard in the distance. They soon came up with plenty of water and kindling wood. Then we built a series of good fires and the menace of lions was soon forgotten.

I began work skinning the buffalo at once, aided by the light of burning faggots which the boys held over my head. The job continued until one o'clock in the morning. After broiling a slice of buffalo meat over glowing embers, I slid down exhausted on the grass and fell asleep.

Before the first signs of dawn, accompanied by one porter, I made haste to reach camp to get salt, so vital to the preservation of the specimen. If I failed, the thick skin would rot in a few hours and there would be nothing worth taking home. It was a long, hard journey back to camp, and for the first few miles I ran a good part of the way. Then the lack of food and sleep began to tell; the high, matted grass seemed to trip me at every step. As we crossed the slopes of a low,

flat-topped hill, I gave the porter my gun to carry. It was the first time I ever allowed a native to carry it, and what followed taught me a lesson. Almost immediately, eight buffaloes with splendid heads pushed their way through a patch of long grass directly in front of us, and the boy, instead of handing me the rifle, began making off. Although he did not bolt, he was so far out of reach that, if the herd had charged, I never would have had a chance to get that rifle. Luckily for us, after they had satisfied their curiosity, they galloped on.

We reached camp at eight o'clock, where a good breakfast soon put us in shape again. Then, with the motor truck and plenty of salt, I worked my way out over the plains to the spot where Muleim stood guarding our prize from the vultures and hyenas that lurked in the offing. The chase was over and the hard part of our labors was now nearing an end.

The complete skeleton and the skin were saved for science and started on the long journey to a permanent home in the American Museum of Natural History.



ON THE RANGE OF THE AFRICAN BUFFALO

Photograph by Martin Johnson



Photograph by Major A. R. Dugmore

The Snowy Summit of Kenya, from the Grassy Downs of Its Northerly Base

UP KENYA IN THE RAINS

A Visit to the Second Highest Mountain in Africa, Which, with Its Glaciers and Snow Fields, Lies Ten Miles South of the Equator

IN TWO PARTS—PART II

BY JAMES P. CHAPIN

Associate Curator of Birds of the Eastern Hemisphere, American Museum

WITH SIX DRAWINGS BY FRANCIS L. JAKUES

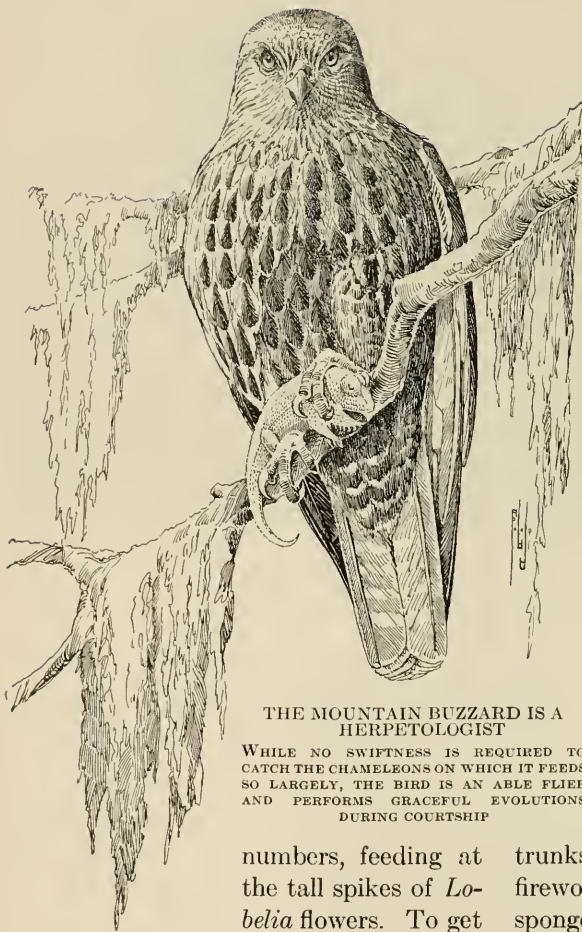
NOTE.—Part I of this article appeared in the November–December, 1933, issue of NATURAL HISTORY

WHEN time is limited, the wise course in climbing a mountain is to go up rapidly and tarry on the way down. Under other conditions it would be as well to travel slowly, to accustom one's heart to the decreasing pressure. We had risen 5000 feet on Mt. Kenya in two days, and the third day would take us nearly as high again. A drizzling rain delayed our departure from the rest-house, and later began again, so our porters set up a little tent and crowded into it.

Mathews and I were paying little attention to them, for we had just caught sight of some large sunbirds (*Nectarinia johnstoni*) busy at a patch of white *Protea*

flowers. Here was an antidote to cold rain and wet feet! More than any other bird on Kenya this was the one I had longed to meet. Males are largely metallic green, with two lengthened tail-feathers and tufts of scarlet at the sides of the breast. The other sex is short-tailed and brown, but with similar red pectoral tufts.

In South Africa, where proteas abound, they are called sugar bushes because of the abundant nectar the flowers secrete. The few species of *Protea* in equatorial Africa do not seem to supply so much liquid food, and these mountain sunbirds eat many tiny insects, including beetles. Higher up on Kenya, above 14,000 feet, we again found Johnston's sunbirds in



THE MOUNTAIN BUZZARD IS A
HERPETOLOGIST

WHILE NO SWIFTNESS IS REQUIRED TO
CATCH THE CHAMELEONS ON WHICH IT FEEDS
SO LARGELY, THE BIRD IS AN ABLE FLIER
AND PERFORMS GRACEFUL EVOLUTIONS
DURING COURTSHIP

numbers, feeding at the tall spikes of *Lobelia* flowers. To get at these blue flowers the birds have to push their long beaks far in among the hairy bracts that almost hide the blossoms.

The porter question now demanded attention and some loud words. The Esperanto of eastern Africa—Swahili—is a great help, and finally our little caravan moved upward again. A fog enclosed us, it rained intermittently, and often there was no sign of a path. I wondered how we knew where we were going until the guides pointed out small bamboos stuck in the ground at intervals by a previous party.

Thus far the climbing had been gradual. The whole lower slope of Kenya has been weathering so long that few boulders are left—only a brown volcanic soil. Now we began to see gray rocks jutting out of the ground, and soon on our left a tremendous

gorge, that of the Nithi River. There were eight hours of steady travel, we knew, between the lower hut and the Lewis Glacier. Plainly, we would not make the glacier that day. Lake Michaelson, a calm pool of dark water, lay hidden in the fog of the gorge below us.

Presently we found ourselves scrambling over the rocks near the head of the Nithi gorge, where it closes in above the lake. Up on a sort of shelf near this point is an enormous boulder, with considerable overhang on one side. Mr. Carr had noted it on his diagram as the "Big Stone," and when Mtwámuthára led us up to it in the latter half of a sloppy afternoon, there was no better place to camp. All about here grew two very different types of large *Senecio*, one sprawling over the sodden ground, the other a real tree. Dead

trunks of the latter were the only available firewood, but they were as full of water as sponges. Clever a cook as Enoka was, he worked an hour and a half, using two gallons of kerosene, to get a smoky wood-fire started under the shelter of the rock.

It was a miserable camp, more so for our black companions than for us, even though the temperature that night dropped only to 42.5°—the altitude being 14,000 feet. The next morning we felt amply repaid. The air about us was perfectly clear, the bright sun low in the east warmed us, and far below was the thick cloud-bank, spread out in a level blanket hiding all the landscape beyond our mountain slope and Lake Michaelson. Looking downward at sky effects is one of the rewards in mountaineering.

We wanted to look up at the peaks as well, but here the best view was cut off by a near-by ridge. Leaving camp with

light hearts and shortened breath, we climbed into a higher valley with broad, level floor, said to be formed of old, dry, lake beds. On the way, the twin peaks of Kenya's summit came into view, with little snow that day on their precipitous sides. The glaciers that gather snow and turn it to flowing ice are about twelve in number, or fifteen if the very small ones are counted; but from this angle glimpses could be had of only the Gregory and Kolb Glaciers. The peaks and their satellites, jagged rocks like Point Lenana, looked dark brown by the morning light.

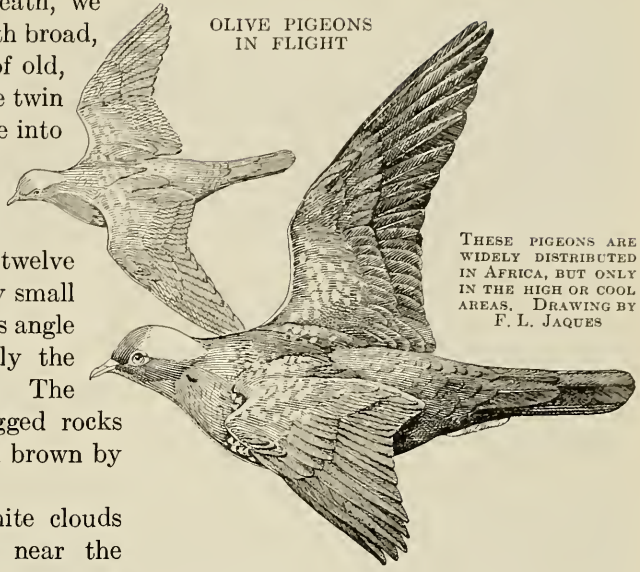
One or two fleecy little white clouds were beginning to condense near the summits, a warning that the glorious view would not last. Our guides pointed out the spot where we would climb over the ridge far ahead, near a small, sharp pinnacle called the Thorn. Our guns had been left in camp, Mtwámuthára begging us not to shoot in the higher levels, lest rocks or ice come

THE PLANTAIN-
EATER OF
KENYA

IT RUNS AND HOPS
AMID THE BRANCHES
WITH THE AGILITY
OF A SQUIRREL



OLIVE PIGEONS
IN FLIGHT



THESE PIGEONS ARE
WIDELY DISTRIBUTED
IN AFRICA, BUT ONLY
IN THE HIGH OR COOL
AREAS. DRAWING BY
F. L. J. RQUES

tumbling down on us. In the native imagination great mountains usually have powerful spirits on them, who may not like noise, so probably some superstition was the real cause of his concern.

Practically, a gun would have been a useless burden. No different birds were now expected, and it was much more helpful to carry a light bamboo pole on which to lean. I for one did plenty of leaning that day. At the head of this valley we were close to 15,000 feet. All vegetation was fast petering out. There were still lobelias, which straggled up to 15,700 feet, and a few stunted *Senecio* trees. A cresslike plant and a yellow-flowered composite still survived near the highest lobelias, but beyond that only a little moss, and the lichens that grow on rocks.

A flock of two dozen white-bellied alpine swifts (*Micropus melba africanus*) circled over us at 14,500 feet, two of the large starlings already mentioned were still in evidence among the rocks close to 15,000 feet, and a few Johnston's sun-birds flitted to and from the flowering lobelias up to that same level. Several red-tailed buzzards were noted, including



*Photograph by
Frank P. Mathews*

CAMP AT THE "BIG STONE"

The rock could not shelter more than a few of the party, so it was used as a kitchen, and there the porters sought warmth during a cold, wet night



MATHEWS IN AN ALPINE FLOWER SHOW

A photograph snapped during a misty drizzle, as Mathews stood beside a huge flower-spike of *Lobelia*. Here is more truth about the mountain weather than in the many pictures made during clear intervals

*Photograph by
Frank P. Mathews*

THE CLOUD-BANK BELOW AT DAWN

View down from the head of the Nithi Valley at 14,000 feet, and out over the top of the clouds before they began to rise as the mountain was warmed by the sun



A DASHING BROOK AT 10,500 FEET

A few tree-senecios overhung it, and beard-lichen weighted the bushes all about. This photograph was taken by Herbert Lang in 1906



birds of both color-phases, with white and with black underparts.

The next stage was a climb of about a thousand feet up a steep slope of earth and small boulders, known to Mr. Carr and his fellow alpinists as the Scree. The word is from the Icelandic—an appropriate derivation, it seems to me. The half-dozen blacks who accompanied us now were carrying next to nothing. Mathews was in good form, and kept up with them very well. Sage and I were feeling the strain, we stopped frequently to lean on our bamboos and pant. Always there would be a wiry Mwimbi standing a little higher up, mutely suggesting that we start up again.

Mathews, noting our difficulties, reminded us that we had smoked a few cigarettes at the last camp. Had we loved him less we would have felt inclined to push him over a cliff. We hadn't breath enough to tell him what we thought. Eventually Sage and I reached

the top of the ridge, and had an enchanting view down into the Hobley Valley beyond. There nestled three little lakes, not robin's-egg blue as one finds them in the Alps and Rockies, but nearer pea-green. This broad valley, once occupied—it is evident—by a glacier larger than any now existing on Kenya, is drained by the Ruguti River flowing down to the southeast.

We now saw our advance guard picking its way downward and to the right across a tremendous rock-slide. The gray blocks were of hard lava that once cooled deep down in the neck of the dying volcano, then far higher than the Kenya of today. Soon the men were moving up again, and we could guess that they were close to Carr's upper hut. Mathews, too, was far ahead, and I did not catch up again till we reached the hut, close by the little "Curling Pond" at the margin of the Lewis Glacier. Somehow I always think of it as the Skating Pond, no doubt because of a photograph of Mr. Melhuish of Nairobi skating on its frozen surface. But at the time of our visit it was all water, and skates would have been useless.

The hut was of the same construction as that lower down, and its trim outlines gave no hint of the labor and persistence required of Mr. Carr, his friends, and their sturdy black porters, to place it there. Inside lay ice-axes and ropes, suggestive of the repeated attempts to scale the highest peak, Batian, which had only once been conquered, by Mackinder and his Swiss guides, twenty-seven years earlier.

Not until three years after our visit to Kenya did men again set foot on the culminating point of the great mountain. In January, 1929, Harris, Shipton, and Sommerfelt were at last able



A MALE JACKSON'S
FRANCOLIN

THE SPURS ARE CHARACTERISTIC OF THE COCK, WHICH IS SOMEWHAT LARGER THAN THE HEN. A RICH RUFOUS COLOR PREDOMINATES IN THE SCALY PATTERN OF NECK, BREAST, AND FLANKS. *FRANCOLINUS JACKSONI* OCCUPIES THE HIGHER LEVELS OF KENYA COLONY, AND OTHER ALLIED SPECIES OF FRANCOLIN ARE FOUND ON MOUNTAINS OF NORTHEAST AFRICA AND THE EASTERN CONGO

to reach the top of Batian, and also that of Nelion, its twin, which, though forty feet lower, had never been ascended.

The Lewis Glacier, its rounding snowy surface now separating us from the base of these two peaks, is the largest ice-field on Kenya. On Mackinder's map it is shown as one mile long. We were able to look across at the dark base of the peaks, and sometimes could make out the snow-filled couloir that has served as a way upward, but nothing more. Since nine o'clock that morning the rest had been completely hidden in fog.

Now that it was nearly noon, we ate our lunch and wandered about, most of our native companions mean while sitting huddled under their blankets. The temperature at one o'clock was 41° . Water boiled at 183.8° , and with correction for temperature, in comparison with earlier observations at Chogoria, the altitude would be approximately 16,014 feet. The hand of my aneroid had moved beyond the end of its 16,000-foot scale, and seemed to indicate about 300 feet above that figure. The last thousand feet are the hardest on Kenya, and they have baffled all but the most expert alpinists. We were mere naturalists.

Little did I expect any bird about this glacial spot, yet while we were there two red-tailed "augur" buzzards came soaring overhead. Down in the valley below they would find a constant supply of



THE RUGGED PINNACLES OF KENYA

Photographed from the northern side at 9000 feet by Major A. R. Dugmore. Close together in the center are the twin peaks: Nelion on the left, Batian to the right. Farther to the left is the Gregory Glacier, descending from Point Lenana. The large rocky eminence on the right is Point Piggott

rats, but here they seemed to be spying on our unwonted intrusion. Wishing and waiting have no effect on weather. A watched mountain is as stubborn as a watched pot. Instead of complaining about the clouds, we ought to have congratulated ourselves because it did not snow. Finally we had to leave, in order to reach camp at the Big Stone before night. There were no more views except of the immediate foreground.

To meet the first flowering plants again on the way down was a delight. The Scree was friendly now, and in the dry lake-beds our men caught a few rats by



THE HIGHEST BUILDING IN KENYA COLONY

Ernest Carr's wooden hut beside the Curling Pond. On the ground outside lay an abandoned stepladder marked with the name of a Nairobi carpenter. It looked strangely out of place; an Eskimo dog-sledge would have seemed more appropriate

NEAR THE UPPER LIMIT OF FLOWERING PLANTS

Lobelias coming into bloom, and a small tree-senecio to the right, at nearly 15,000 feet, close to the foot of the Scree. On the left Mtwámuthára matches his height with the lobelias





*Photograph by
Frank P. Mathews*

**CORYNDON PEAK
MIRRORED IN A TARN**

Now and then a pair of brown
ducks (*Anas sparsa*) alights
on such a pond, but otherwise
there are no water birds



**LATERAL MORaine OF THE
LEWIS GLACIER**

Rocks and earth pushed out
by the ice offer a pathway
from the Curling Pond in the
direction of Point Lenana.
The moraine and crevasses
in the ice are partly covered
by a recent fall of snow

*Photograph by
Frank P. Mathews*



A SUNBIRD NEST

The swinging nursery of *Nectarinia tacaze*, from which the young were just taking their departure. Note how the entrance is shielded from above

cornering them in shallow burrows beneath the grass-tussocks. We reached camp in a light rain, and a mild headache was my only ill effect from the day's work.

As we walked cheerfully down to the lower hut the next day, the going seemed so easy. We continued to note the altitude at which conspicuous plants disappeared and others appeared. At 13,400 feet, along this route, the large lobelias had vanished, and the heath-bushes reappeared. The smaller, sprawling species of *Senecio* still grew in patches at 12,300 feet, and more sparsely down to 10,800 feet. At 12,000 feet the *Protea* bushes showed again, and continued down almost to the lower hut, near 10,000 feet.

Here we decided to spend a day, to see more of the birds, but of these I have told in Part I. Thermometers we had left in the hut showed that during four days the temperature had ranged from 41.5° to 66°. Yet it was amazing how warm we felt when we tried to beat the scrub for francolins.

So on May 15 we plunged again into the bamboos and camped that night at Maironi. It was here, the next morning, that I saw the first yellow-billed kite (*Milvus ægyptius parasitus*) noted since we left Mombasa in late March. Neither did we see another till we reached Uganda in July.

Reputedly one of the most ubiquitous birds of tropical Africa, this kite is strangely absent from certain regions during a part of each year. To me the migrations of some of the birds that breed in the tropics furnish the most devastating evidence against the theory that bird migrations first developed in response to the Ice Age of the north.

As we tramped downward again through the forest from Maironi to Mbo-gori's we were in a mood to sing hymns. I thought up "from Kenya's icy mountain to Mombasa's coral strand," but most of my companions were far ahead. Now I could not resist the temptation to stop, look, and listen. The man carrying my camera was annoyed, as all Africans are by anyone's lingering along the road.



JOHNSTON'S SUNBIRDS

THE WHITE SUGAR-BUSH BLOOM, LARGE AS A CHRYSANTHEMUM, IS ONE OF THEIR FAVORITES. FEMALES OF THIS SUNBIRD LACK THE TWO LONG TAIL-FEATHERS OF THE MALE

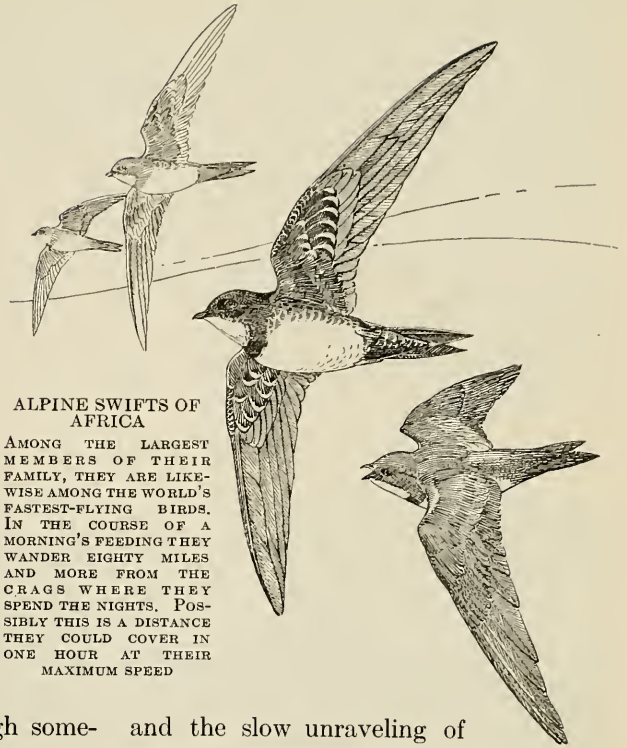
"Let's go," is their feeling, but it was not mine as I bade farewell to this wonderful forest.

Some of the birds I might never see again, others, like the white-headed wood-hoopoe, I had known years before in the Congo lowlands. Still others, such as the blue-spotted guinea fowls, were only racially different from old acquaintances in the western lowlands. There seemed to be all degrees of resemblance and difference between these mountain birds and those of the hot lowlands of West Africa. Animals now and then "snap their fingers" at our synthetic "laws" of geographic distribution. Would it not be wiser to admit that many of our fellow creatures are adaptable—even though somewhat less than we?

Perhaps reflections of that nature were slowing my pace. We had indeed fallen far behind. My black mentor reminded me, not once but often, that we could not reach Mbogori's before dark. He was right, night was falling as we balanced our way across the Mara River and came out of the forest.

We had left Mbogori's on May 9, and returned May 16—eight full days, but a very brief initiation to the lore of Kenya. It seems to me now that we did unexpectedly well, nor do I regret the next couple of days spent in the vicinity of Chogoria. There were still other montane birds to be met, and I profited by it.

After nightfall we heard the high-pitched trilling whistle of a goatsucker, which we eventually identified as *Caprimulgus poliocephalus*, characteristic of the highlands of eastern and northeastern Africa. Only thus, little by little, we come to know the fauna of a given region. Mysteries fade, as in a detective story,



ALPINE SWIFTS OF AFRICA

AMONG THE LARGEST MEMBERS OF THEIR FAMILY, THEY ARE LIKEWISE AMONG THE WORLD'S FASTEST-FLYING BIRDS. IN THE COURSE OF A MORNING'S FEEDING THEY WANDER EIGHTY MILES AND MORE FROM THE CRAGS WHERE THEY SPEND THE NIGHTS. POSSIBLY THIS IS A DISTANCE THEY COULD COVER IN ONE HOUR AT THEIR MAXIMUM SPEED

and the slow unraveling of truth provides thrills far more satisfying than the double-distilled "adventure" of books like Haggard's African novels.

Again we were dining in homelike surroundings with the Irvines. I could not conceal my own amusement as I asked Doctor Irvine whether he had read *Allan Quatermain*, and whether he ever compared himself, as a Scottish missionary, with the genial Mr. Mackenzie, who avenged the kidnaping of his young daughter by bending his best beloved carving knife on the breast-bone of a rascally Masai.

The Doctor's children were still too young to take an interest in mysterious "Goya" lilies, reputed to bloom but once in ten years. Whether this wondrous plant that lured Flossie Mackenzie into deadly peril has even been rediscovered I leave you to guess. But their nurse, Miss Lemaire, was fond of flowers, and enthusiastic about mountains. She had once accompanied a party of alpinists up

Mount Kenya. Before that she had obtained from her native Switzerland a packet of seeds of alpine flowering plants. These, she told us with pride, she had scattered on the heights of Kenya in the hope that they would grow there. Could she imagine how fervently I hoped they had perished? Edelweiss is a jewel in the Alps, it would be a weed on Kenya. I trust that I have been rightly informed,

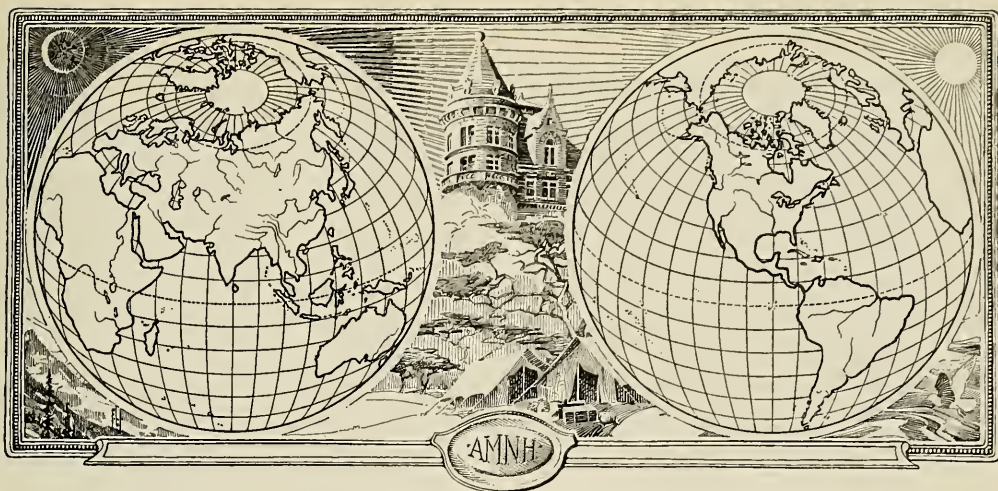
and that the *Scabiosa* of Mount Kenya is a native!

For three mornings in succession, after we came down off the mountain, the summit of the "Mount of Whiteness" showed itself regularly, from about sunrise till eight or eight-thirty. What greater solace could we ask as we were obliged to drive off on the muddy road toward Fort Hall?



ALPINE MOORS OF KENYA, AT 14,200 FEET

View from eastward, with the twin peaks in the background, Batian on the right. Except on the glaciers the snows had all melted. It was about eight in the morning, and a small cloud was forming near the base of Nelion. In half an hour the peaks were hidden. The very small projection close to the left margin of the picture is the Thorn, where the ridge was crossed on the way to the Lewis Glacier



SCIENCE IN FIELD AND LABORATORY

Expeditions—American Museum Activities—Education—
Meetings of Societies—New Publications

EDITED BY A. KATHERINE BERGER

EXPEDITIONS

TAHITI.—Mr. Roswell Miller and Dr. H. L. Shapiro have just returned from a successful trip to Tahiti. During their month's stay at this island Doctor Shapiro carried on investigations in physical anthropology among the natives, and Mr. Miller obtained motion pictures in color of the coral-reef life of the sea floor.

THE 1933 DINOSAUR EXPEDITION OF THE AMERICAN MUSEUM.—Owing to shortage of funds, this expedition was reduced in personnel and scope. Mr. Barnum Brown left New York for Montana, Wyoming, and South Dakota, late in the summer and was joined at Billings, Montana, by Darwin Harbicht who assisted him in the field.

The main object this season was to remove the heavy sandstone covering two large herbivorous dinosaur skeletons, found in the Big Horn Basin near Greybull, Wyoming, in 1932. This work was accomplished and the remainder of the season devoted to reworking the lower Cretaceous beds on the Crow Indian Reservation and exploration for new fossil territory. In a new locality near Harlowton, Montana, several new types of invertebrates and dinosaurs were discovered.

NATURAL HISTORY is expecting to publish a detailed account of this find in a later issue.

BIRDS

THE "NEW FOREST" BIRD GROUP AT THE AMERICAN MUSEUM.—Bird Life in England—a scene of great beauty in a primeval forest set aside by William the Conqueror as his hunting

ground, and ever since preserved by the Crown,—New Forest,—this is the setting of the seventh and one of the loveliest of a series of groups designed to depict bird life in the major faunal areas of the globe. It is the gift of Mrs. Carll Tucker, and is dedicated to the memory of the late Lord Grey of Fallodon.

The formal unveiling of the group took place in the Hall of the Birds of the World on the second floor of the Museum at 4 o'clock, Monday, October 16, with President F. Trubee Davison presiding. The British Government was represented by Consul General Gerald Campbell, and addresses were made by Prof. Henry Fairfield Osborn, Dr. Frank M. Chapman, under whose direction the group was assembled and prepared, and Director George H. Sherwood. Mr. Francis L. Jaques assisted with the unveiling.

Considerable historic interest is centered in this bird group because, when choice was being made of a locale for the birds of northern Europe, the selection settled upon that place in England that seemed to offer the greatest interest to American bird lovers,—the route covered by Viscount Grey and Col. Theodore Roosevelt almost a generation ago when Roosevelt visited England to study its birds. This included the Valley of Itchin and the New Forest.

Before leaving the White House in March, 1909, President Roosevelt asked Lord Bryce, then British Ambassador, to arrange to have some English ornithologist take him afield when he, in June, 1910, would visit England on his way home from Africa. This desire was communicated to

Viscount Grey, then Sir Edward, Secretary of Foreign Affairs. He replied that he himself would serve as Colonel Roosevelt's guide.

In June, 1910, these two famous naturalists went to Tichborne, walked to the Itchin, which they followed to the environs of Winchester. Then they motored to the New Forest which they crossed on foot to Forest Park Inn.

It is a spot on this latter part of their walk that is perpetuated in the Museum's group. Viscount Grey's interest in the American Museum and its plans is best shown by the fact that when the artist, Mr. F. L. Jaques, and Doctor Chapman went to England in 1932, he personally guided them over the path he had taken with Mr. Roosevelt. When they finally, with Viscount Grey's coöperation, selected the setting for the habitat group, Mr. Jaques not only made a faithful reproduction of it, but samples were taken of leaves, branches, plants, and flowers, so that the reconstructed material would be not only life-like but also accurate.

Many distinguished ornithologists were present at the ceremony of the unveiling of the group, which is now open to the public.

EDUCATION

THE AMERICAN INSTITUTE'S CONTRIBUTION TO THE SCIENTISTS OF THE FUTURE.—Part of the scientific educational program of the Junior Science Clubs of the American Institute is a

series of special workshop courses with which the American Museum and the Museum of Science and Industry in New York City have been co-operating. In these courses the children have been taken behind the scenes at the two museums, and taught how to make their own exhibits.

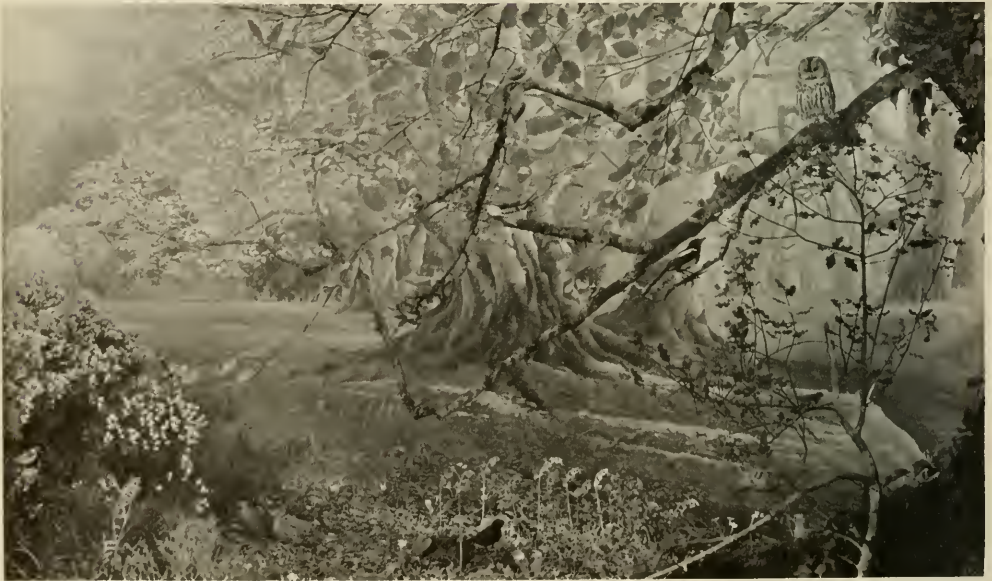
Mr. William Carr, director of the Nature Trails and Trailside Museum which are maintained by the American Museum at Bear Mountain, New York, conducted two groups of biology clubs on "The Technique of Making Habitat Groups" and "Nature Handicraft."

THE JUNIOR ASTRONOMY CLUB, which is sponsored by the American Museum's departments of astronomy and education, has established a lecture bureau which offers to provide junior speakers on astronomy to any organization within a moderate radius of New York City.

FISHES

A thresher shark (*Alopias vulpes*), 13 feet 4 inches long, caught off Manasquan, New Jersey, has been presented to the American Museum by Petrosino Brothers of the Washington Market. The shark was on exhibit at the market for several days.

This swift shark is considered a heavy-bodied derivative of the mackerel shark group, but it has no near relatives and is usually put into a family by itself. The whip tail, which in this



THE NEW HABITAT GROUP OF NORTH EUROPEAN BIRDS

A section of the moor-fringed New Forest, near Southampton, England, has been faithfully reproduced in this new group recently opened to the public at the American Museum. It contains no less than sixty species of North European birds, ranging from the tiny gold-crest to the tawny owl.



THE MUSÉE VOLCANOLOGIQUE AT ST. PIERRE, MARTINIQUE

This unique Museum was opened to the public last August. St. Pierre is now an open port directly accessible to all boats, and its new volcano museum (upper right) adds considerable interest to this already celebrated spot in the West Indies

specimen measured 7 feet 2 inches, is used for rounding up the school of fishes upon which it feeds.

The shark has been skeletonized and added to the study collection, with a possible view to exhibiting this skeleton in the future. There are two mounts of the fish in the Hall of Fishes of the World.—F. LAMONTE.

HISTORY OF THE EARTH

A VOLCANOLOGICAL AND HISTORICAL MUSEUM AT ST. PIERRE, MARTINIQUE.—The volcano museum of St. Pierre was opened to visitors on August 27 last. Founded by Frank A. Perret, the American volcanologist, by the aid of American and local contributions, this institution provides exactly what has hitherto been lacking at this historic spot—a collection of the marvelously interesting relics dug from the buried city; numberless specimens of volcanic bombs, ash, and lava forms in great variety from Mount Pelée and all the volcanoes studied during thirty years of intensive volcanological research, as well as a unique series of photographic enlargements illustrating not only the fearful fire-avalanches of Mt. Pelée but virtually every type of volcanic phenomenon.

The catastrophe which overwhelmed St. Pierre in 1902 is recorded in views of the town before and after the disaster, and by the effects of the volcanic blast in melting glass and metal objects, and the carbonizing of bread, spaghetti, coffee, books, cloth, fruit, etc.

The museum is situated on the main street, a few minutes' walk from the boat landing, and commands a magnificent view over the new town, the roadstead, and the imposing new dome of the great volcano, still smoking after the recent eruption.

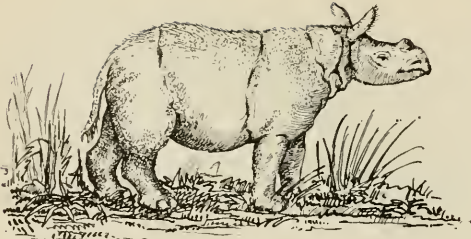
Admission to the museum is ten cents (2 francs) on ordinary days, and fifteen cents (3 francs) on Sundays and holidays. Children 5 cents. The museum is open every day in the year. Postcards, photographs, and relics from the ruins are on sale.

Readers of NATURAL HISTORY will recall the article "The Volcano Museum on Mount Pelée" contributed by Dr. C. A. Reeds to the January-February issue, 1933, which was so beautifully illustrated with photographs taken by Mr. Frank A. Perret, director of the new museum.

MAMMALS

THE SONDAICUS RHINOCEROS.—Never in the whole zoölogical history of the American Museum has there been more persistent, intelligent, and generous endeavor to secure a certain rare and nearly extinct species for the collections than that of Mr. Arthur S. Vernay in his six years' effort to add the *Rhinoceros sondaicus* to his remarkable Asiatic Hall collection.

While his last expedition failed to secure the large *Sondaicus* bull which he was expecting to find according to all recent reports, Major G. S. Rowley, who conducted the expedition in the absence of Mr. Vernay, was fortunate in obtaining another specimen which comes in the nature of a consolation prize, namely, a fine bull of *Rhinoceros (Dicororhinus) sumatrensis*, the two-horned rhinoceros of Sumatra, which is also becoming one of the greatest rarities of modern zoölogy. This specimen was shot on June 20, 1933, at Sungei Bugis, Bernam River, Selangor, Federated Malay States, and was received at the American Museum September 19, 1933. It will form a splendid companion to the female *sumatrensis* which fell to the rifle of Mr. Vernay on May 2, 1924, and is now in one of the cases of the



SONDA RHINOCEROS

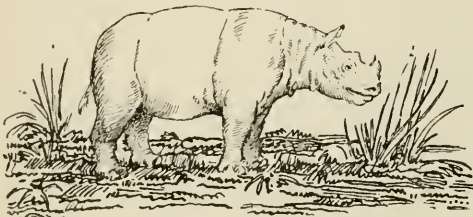
Vernay-Faunthorpe Hall of South Asiatic Mammals.

Mr. Vernay writes, September 7, 1933, that this particular bull is presented by His Highness the Sultan of Selangor, who has previously been most kind in helping us with the *Sondaicus* rhinoceros. There is still a chance of getting the *Sondaicus* rhinoceros from Selangor.

At the November meeting of the Trustees, Major Guy S. Rowley was elected an Honorary Member of the American Museum in recognition of his great service in spending three months in the search for the *Sondaicus* rhinoceros, a period of extreme hardship ending in great disappointment. In Mr. Vernay's words

No one could have been more conscientious and keen than he has been, and it is through his help that we have left Malaya, for the time being, with every evidence of kind coöperation between the Museum and the Resident.

In the course of preparing for the capture of the rare *Rhinoceros sondaicus* Mr. Vernay has studied the feet of the three types of Indian rhinoceroses likely to be encountered by the hunter, and has drawings and photographs of the tracks of the

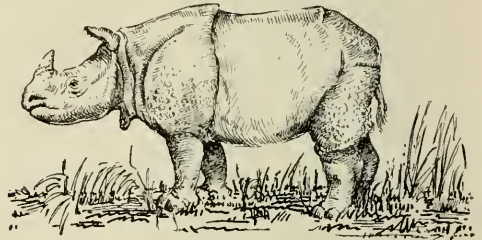


SUMATRAN RHINOCEROS

Indian rhinoceros, the Sumatran rhinoceros, and the Sonda rhinoceros. Aside from some differences in size, it was discovered that the pattern of the track made by each species varied in a characteristic fashion from that of its relatives.

In assembling this data Mr. Vernay had sketches of the feet of mounted specimens in the American Museum and in the Museum of Comparative Zoology at Cambridge; and obtained prints of actual tracks from a rhinoceros in the Bronx Zoological Park which obligingly walked across a prepared surface. The only mounted specimen of the Sonda rhinoceros available for this study at the time Mr. Vernay was seeking to distinguish between the footprints, was the specimen in the Museum at Cambridge, but later he secured sketches and studies of tracks made by the wild animals of known identity in southern Asia.

Assisted by this ability to identify the rhinoceros by its tracks, Mr. Vernay brought to a



INDIAN RHINOCEROS

successful conclusion his hunt of 1932 for that specimen of the Sonda rhinoceros which was donated to the British Museum. Apparently there are but very few remaining specimens of this rhinoceros in existence, and since the greater number of these, if not all, are scattered, solitary animals, living under conditions which remove them from consideration as possible breeding stock, it is highly important that one of these creatures finds its way to the American Museum where it may be associated with the splendid aggregation of large mammals in the Vernay-Faunthorpe Hall. The remnants of this species are fated to die of old age or before the weapons of the natives seeking it for medicine, and Mr. Vernay deserves the good wishes of all in his endeavor to thus perpetuate in museums a species on the brink of certain extermination.

As on the expedition which secured the specimen for the British Museum, Mr. Vernay's party was equipped to make the fullest possible use of any specimens taken, for not only was a skin and complete skeleton preserved on that occasion, but also all of the external and internal parasites and such parts of the soft anatomy as merited special study. Incidentally, while the question of parasites might seem to the layman of

small moment to any other than the creature carrying them, often significant side lights are shed upon the question of origin by the species of parasites living upon the form in question. In other words, if it were possible to know something of the parasites which lived upon the mammals known to us only as fossils, it would conceivably be much easier to restore the branches of the family trees. The parasites of the Sonda rhinoceros were acquired from the associates of some remote epoch and are an index to the company it kept. It is fortunate that Mr. Vernay collected a representation of these before the extermination of the host.

THE GIANT SABLE ANTELOPE GROUP IN THE AMERICAN MUSEUM.—In Mr. Albert E. Butler's article in the September-October number of *NATURAL HISTORY*, "Transplanting Africa," he featured the group of giant sable antelope, which is to be one of the attractions in the new Akeley Hall of African Mammals. Mr. Butler's account of the work in the field, collecting accessory material and making background studies for this group, was necessarily brief because of space limitations. It is impossible to think of the giant sable of Western Africa without recalling Mr. H. F. Varian, whose name has been inseparably linked with that of the antelope which is known to science as *Hippotragus niger variani*.

The story of the giant sable is an interesting side light on the important part played by Mr. Varian in the study and development of Angola, and the intimate relationship between the history of the animal and the activities of the man places more than the customary significance upon the scientific name of the antelope. It seems most appropriate that the splendid group which Mr. Arthur S. Vernay has so generously collected and donated to the Museum will stand as a monument both to him and to Mr. H. F. Varian.

Mr. Varian's interest in the American Museum group of giant sable antelope goes back to the very beginning, and it was his generous coöperation with Mr. Vernay, when he used his influence and knowledge to assist in every way, which insured a successful outcome and the securing of the animals themselves. When Mr. Butler and Mr. Rosenkranz arrived in Angola, he again offered his services and not only aided in the various official matters of entry into the country, but also kindly placed at their disposal the facilities of his home at Lobito and his home at Huamba, and drove them in his own car the 175 miles to Quanza.

Mr. Butler has written of "transplanting Africa," but, in the case of Angola, the American

Museum has acquired more than a biological and geographical accession. The Museum has established an association with a personality, and it is fitting that one of the finest of Africa's superb antelopes stands as a tribute to Mr. H. F. Varian.

HYDE MEMORIAL PARK

ON November 15, 1933, Mrs. B. T. B. Hyde, on behalf of herself and her sister-in-law, Miss Mabel L. Hyde of New York, presented to the State of New Mexico, a 350-acre park in Little Tesuque Canyon. This area is to be known as Hyde Memorial Park, "to perpetuate and carry out the ideals and purposes of 'Uncle Bennie,' who acquired the land as mountain headquarters for his Boys' Nature Foundation."

Mr. Hyde, who died in an automobile accident in July of this year, had been a Patron of the American Museum of Natural History for many years. It is fitting that his Memorial should consist of an out-of-doors area for the enjoyment of the people, for, during the last years of his life, Mr. Hyde's principal interest was in encouraging people to become familiar with the out-of-doors.—W. H. C.

OLIVER CUMMINGS FARRINGTON

DOCTOR Oliver Cummings Farrington, one of the world's leading authorities on meteorites, gems, and gem minerals, died on November 2 at the age of 69 years. Doctor Farrington had been Dean of the Field Museum for many years, having joined its staff a few months after it was founded. He had been curator of geology since 1894. During his notable career, Doctor Farrington served on the faculty of Yale University, lectured at the University of Chicago, and for a time was connected with the United States National Museum. He led numerous expeditions, of which the Marshall Field Geological Expedition of 1922-23 is particularly notable. On that expedition he spent seven months in the interior of Brazil, traveling eight hundred miles by mule train and doing important work in the unworked mineral fields.

Doctor Farrington was president of the American Association of Museums during the year 1915-16.

MEETINGS OF SOCIETIES

FIFTIETH ANNIVERSARY OF THE AMERICAN ORNITHOLOGISTS' UNION.—Among the most notable gatherings to which the American Museum has had opportunity to extend hospitality recently, was the semicentennial anniversary celebration of the American Ornithologists' Union and its 51st stated meeting, which con-

vened there from November 14 to 16. The sessions were open to the public, and it is believed that this golden jubilee drew the largest attendance in the history of the Association.

Dr. Frank M. Chapman, dean of American ornithologists and curator-in-chief of the department of birds at the American Museum, had full charge of the plans for receiving the visiting bird men. President F. Trubee Davison gave the welcoming address, to which Dr. Alexander Wetmore, assistant secretary, Smithsonian Institution, responded on behalf of the Union. The three days were devoted to an elaborate program of papers and discussions by outstanding ornithologists from all parts of the country, followed over the week end by special excursions to Hempstead Lake State Park, Jones' Beach State Park, the New York Zoological Park, the Roosevelt Bird Sanctuary at Oyster Bay, the home of Mrs. Theodore Roosevelt at Sagamore Hill, the New Jersey Pine Barrens, and independent field trips in the New York City region. The anniversary dinner was held at the Hotel New Yorker on the evening of November 15. The members of the Union were also entertained by Dr. C. H. Townsend at a smoker in the New York Aquarium, and by Mr. and Mrs. Carl Tucker at their home in New York City.

One of the notable incidents of the conference was the presentation of the Brewster Medal to

Doctor Chapman for his authorship of the *Handbook of Birds of Eastern North America*, Revised Edition, 1932.

In celebration of the Fiftieth Anniversary of the Union, a special exhibit of "Birds in Art" was arranged in Education Hall of the American Museum by the New York Local Committee, which had brought together a comprehensive selection of works representing birds either in a natural environment or used in decorative design.

The American Ornithological Union was founded in 1883 at a meeting held in a wing of the American Museum.

ASTRONOMY

THE AMATEUR ASTRONOMERS' ASSOCIATION holds the following meetings during January and February:

January 3—Dr. Herbert J. Spinden—"Mayan Astronomy"

January 17—Dr. John H. Pitman—"Precession of the Equinoxes"

February 7—Mr. James Stokley—"The Fels Planetarium of the Franklin Institute"

February 21—Dr. A. M. Skellett—"Meteors and Radio"

The Association has inaugurated an Amateur Telescope Making Class to be held on Thursday evenings during the winter and spring under the leadership of Mr. Ramiro Quesada.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected to membership in the American Museum:

Sustaining Members

Mrs. WALTER C. BAKER.

Mr. ERNEST R. GEERING.

Annual Members

Mesdames HENRY BAHNSSEN, GORDON L. BEERY, FRANK A. E. COTT, W. R. CRAIG, VICTOR W. CUPPLES, LEWIS L. DELAFIELD, R. G. DUVAL, HENRY GOLDMAN, GEORGE MUNRO GOODWIN, CHARLES E. LUDLOW, ALAN RYAN, JR., WILLIAM C. WHITE, HELEN ZISKA.

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Doctors L. C. DUNN, FRANK E. SMITH, J. HOWARD WILSON.

Messrs. MORRIS W. AXLER, EDGAR A. BEDFORD, CLAUDE BRUCE, EDWIN A. CARTER, WALDEMAR ARENS CHABBOURNE, S. SLOAN COLT, GUSTAVUS W. COOK, J. H. COOPER, GARDNER CORNING, PAUL D. CRAVATH, F. N. DOUBLEDAY, DANIEL J. DOWDNEY, LOUIS DUPUY, W. A. FLINN, ERNEST GALARZA, ROBERT T. GANNETT, DONALD D. GRAHAM, IRVING H. GRISWOLD, TOBY GRUEN, FREDERICK L. GUGGENHEIMER, JAMES HARPER, EDMUND S. HAWLEY, I. A. HERSKOWITZ, GUSTAVUS M. HOLLSTEIN, J. H. MCKINLEY, JOSEPH PLAUT, ALBERT G. REDPATH, FRANCIS J. RIGNEY, GEORGE ROLL, LEONARD PERKINS SAYLES, SCHUYLER R. SCHAFF, S. HARVEY SKLAR, HERMAN T. SPIETH, MILTON S. STEINER, HERMAN STEINKAMP, L. L. STRAUSS, W. STEPHEN THOMAS, J. LESLIE WHITE, WALTER H. WOLFF, HERBERT Z. ZIM.

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Sister HELEN ANGELA.

Misses ETHEL DIETER, JOSEPHINE DODDS, FLORENCE S. DUSTIN, MARY S. GOULD, BERNICE L. MACLEAN, EDITH MASTIN, MATILDA L. MCCARTHY, DOROTHY MEIER, PATRICIA O'CONNOR, ANNA J. ROTHSCHILD, MARGARET STOREY, HELEN C. TALBOT, JOAN WALSH, PRISCILLA WALSH, SUZANNE WALSH, MARY A. WHITE, CHI NYOK WONG.

Rev. Dr. LE ROY GRESHAM.

Reverend ARTHUR F. LEWIS.

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Professor CHARLES CHUPP.

Brig. Gen. M. CHURCHILL.

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BOOKS

Autobiography of a Bird Lover. By Frank M. Chapman. D. Appleton-Century Company, N. Y. 420 pp. 87 ills.

WHY should the autobiography of a bird lover be of any possible interest? Is this one of any interest, and, if so, why? I can imagine that a great many people will ask these questions when they see this book on the stalls for the first time. The answer will occur readily to many and for the rest I can supply it in a word—the answer is that this is Frank Chapman's life history. Now, since this book concerns a man whom I venture to call my friend, I may be presumed to be prejudiced, but I don't think that I am and I have surely tried very hard not to be.

I need not waste time in stating the fact that Chapman knows how to write interesting books. Everyone knows this. This book, however, is something quite different from anything which he has ever tried to write before and, so, although last winter he read me some of the chapters in manuscript, I sat down to read the book with a good deal of natural curiosity. When once I sat down to read it I finished it without pausing to do more than light a fresh pipe from time to time, and when the evening was over, I reflected for a while, knowing that I had the book to review. The whole experience was a very pleasing one.

It is hard to analyze the factors that make this book so extremely instructive and agreeable. Chapman's life has not been more adventurous, more conspicuously successful, nor more eventful from any point of view than very many other lives; so that one seeks a reason for the extreme satisfaction and for the deep feeling of profit which one feels after reading the book. In the first place it is highly informative. It tells a lot of interesting things about a lot of interesting places; in short—much good geographical and zoogeographical information; then there are reminiscences of many different people, each one shrewdly and skillfully recounted; thus, unconsciously one absorbs a vast deal of the history of recent ornithology told in a most charming and delightful way. Such matters as the origin of the American Ornithologists' Union, the Audubon movement, bird protection, the origin of bird reservations, the early days of bird photography are happily dealt with.

Then there is the absorbing story of the

development of the collection of birds at the American Museum which, although not as yet the best organized, the best arranged, nor the most useful collection in existence, is by far the largest and the one which in the new home now ready for it will be of the greatest service to all students of birds. Chapman played a great and distinguished part in bringing together this marvellous assemblage of material, and his story of how this was done is by no means a dry one, either; it is full of the evidence of careful foresight and prophetic instinct, and he gives full mead of praise to the aid of his friend Leonard C. Sanford.

As one reads the story of Chapman's life, one is impressed with the orderliness of its development, of its justified ambition, with the careful way in which every opportunity is grasped, no less than with the development of the man himself. Herein lies a lesson for every young naturalist. The author shows himself not only as a person with widespread acquaintances, but also as one who reserves his warmest and deepest friendship for but a chosen few, and no one can read what Chapman has written concerning his excursions with Brewster and Fuertes without being deeply impressed by the touching and simple way in which these beautiful friendships have been described. To me these seemed the finest episodes in the book, for I also had the pleasure of knowing these men and was delighted to find that which I myself would have liked to say about them so exquisitely expressed.

I venture to say that this book will be read by a very great many people, not only in this year of its first appearance but for a long period of time, very largely because one person will tell another; a father will say to his son, "Read Frank Chapman's life. It will do you good."

—THOMAS BARBOUR.

The Conquest of a Continent. By Madison Grant. Introduction by Henry Fairfield Osborn. Scribners, New York, 357 pp., 14 maps, bibliography.

THE theme of this book is adequately expressed by Professor Osborn in his introductory remark, "I welcome this volume as the first attempt to give an authentic racial history of our country, based on the scientific interpretation of race as distinguished from language and from geographic distribution." The book is above all a history of the peoples who came to America, and the

fates of their respective descendants. It is in this respect that the book is unusual, treating a subject usually ignored in the writing of history. In the main it is a statement of facts, taking up in turn each section of the United States, Canada, and Latin America.

We usually think of the peopling of America as the landing of settlers on the Atlantic coast, overlooking the fact that there was a steadily advancing frontier due not so much to newly arriving immigrants from Europe as to a trek of the old stock to new lands. Thus the more adventurous New Englanders pushed into Ohio after the Revolution; later on this same stock moved into Indiana and Illinois; still later Kansas and even the far west lured them. As stated by the author, "most of the States followed the rule . . . that a State is populated in the first instance by its own increase, and secondly by movements from the States directly adjacent to it." The general picture presented is of an expanding population, old English stocks in the lead, laying the foundations for American culture. Had this migration been otherwise, the stream of non-English peoples from Europe would have found powerful and resisting territorial units. It is due to this swirl of migration that the population remains largely of one general type, "70 per cent Nordic and 80 per cent Protestant, and no one foreign language seriously threatens our English speech."—CLARK WISSLER.

Exploring the Earth and Its Life in a Natural History Museum. By James Lindsay McCreery, Frederick A. Stokes Company, New York, 1933. 262 pages.

MR. MCCREERY'S book should make many new friends for the American Museum of Natural History and should help old friends to a better understanding of its collections and their purpose. His aim, as stated in the Foreword, is to suggest something of the "why" of museum collections and to help the unprepared visitor realize "that each item has its own place in the orderly pattern of the history of the earth and its life." The book is admirably planned and written to accomplish this for both young and old, and should prove good reading even for those who cannot visit the Museum.

In 262 pages of simple text, surprisingly free from confusing scientific names, the author gives an excellent bird's-eye view of the Museum exhibition halls, of the plans and purpose underlying their arrangement, and of their relation to one another and to the evolution of the earth and its life forms. Mr. McCreery briefly traces the development of the earth and the evolution of life from earliest times to the present, as illus-

trated by the Museum exhibits. The visitor is led through hall after hall in evolutionary sequence—geology, fossils, plant life, insects, sea life, reptiles, birds, mammals, and so up to present-day man. This orderly arrangement clarifies a mass of material for the reader. The chapter on each hall has been read by the appropriate curator, and the accuracy of the book is not to be questioned. The book is well printed in large, clear type on heavy paper. Excellent pen-drawings by the author illustrate the text.

Mr. McCreery has made an important contribution to natural history education and *Exploring the Earth and Its Life in a Natural History Museum* should be in the hand of every unprepared visitor who sincerely desires to understand and enjoy the American Museum of Natural History.—H. L. M.

Wellcome Photographic Exposure Calculator, Handbook and Diary—1934

THE value of photography to the explorer and the traveler cannot be overestimated. In fact, at the present time, it is universally considered an indispensable adjunct of any trip. Travel books, scientific reports, and even personal diaries are infinitely more valuable if illustrated with photographs.

Here is a little book suitable for the pocket,—which contains more helpful information for the nature photographer than this reviewer has ever seen in so small a compass. One is shown how to calculate exposure times for various latitudes, including the tropics, for aerial photography at various altitudes, speeds, etc. In fact all of the elements of the art of photography are treated,—lighting filters and color photography, focusing, developing, printing, staining, toning, reducing, lantern slides, etc. In addition about half of the book is given up to space for making a complete and compact record of photographs made—so that one may profit by his experience. Altogether it is a most valuable handbook for one who has had considerable experience with the camera, as well as for the beginner.—CLYDE FISHER.

THE department of ichthyology at the American Museum is pleased to learn of a book on tropical fishes by C. W. Coates of the New York Aquarium staff, based largely on personal experience with the very extensive and interesting collection of such living fishes now at the Aquarium; a book to which it may refer the ever-increasing number of persons interested in keeping fishes in home aquaria. A review of this book will appear in the next issue of NATURAL HISTORY.—J. T. NICHOLS.



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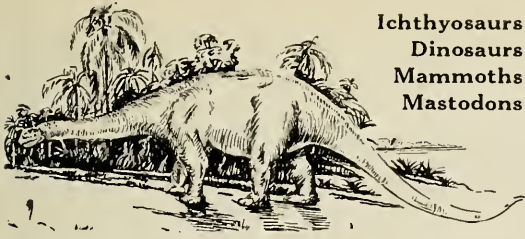
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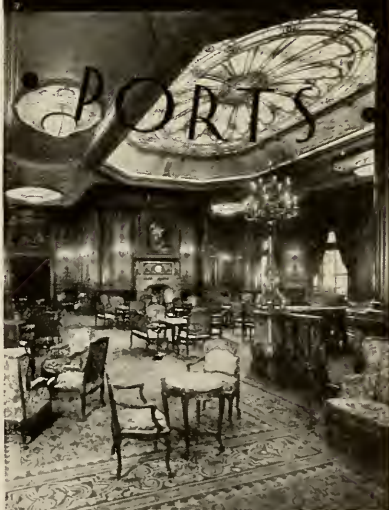
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1934

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BLAZING THE TRAIL

AT the moment this is being written, the sky is very dismal indeed, and the snow is falling, which, by a mental process not too difficult to follow, makes us think of the delights of spring. That is one of the advantages of editorial work, for though February is outside the window, May is, so to speak, on our desk, for the May-June number of *NATURAL HISTORY* is "in the works."

The leading article for that number will be by Edward W. Alexander, assistant curator of the New York Botanical Garden and curator of the local herbarium. His article, which certainly suggests spring, at least to any garden enthusiast, is on water plants.

ZANE GREY, to whom we referred in this department in the last number, has sailed for Tahiti, but before he left, he sent us a most fascinating account of fishing in New Zealand waters. The particular fish he describes is the great mako, a shark with a manner all his own, for which Mr. Grey, whose merits as a fisherman make him an authority, has the greatest respect, as we have, too, now that we have read what Mr. Grey has to say. This article, with its striking illustrations, will appear in the next number of *NATURAL HISTORY*.

DOCTOR MARGARET MEAD is not so frequent a contributor to *NATURAL HISTORY* as we wish she were, for her work among the natives of the very distant islands of the South Seas keeps her very far from the editorial offices of the magazine for long stretches at a time. At present, however, she is in New York, and we are delighted to be able to announce the publication, in the following two numbers, of two articles on certain natives of New Guinea with whom she has lived during her recent expedition to that island.

THERE are, at present, only two planetaria in the United States, but the American Museum will, before long, be the fortunate possessor of a third. Dr. Clyde Fisher, whose previous articles in *NATURAL HISTORY* our readers will recall, is the head of the Department of Astronomy of the American Museum, and consequently is the one person above all others to

describe this great addition to the Museum's exhibits. The next number of *NATURAL HISTORY* will contain Doctor Fisher's account.

WHETHER because of "The Ancient Mariner" or because of its own striking characteristics, the albatross is a bird with more appeal than most. Few of us, however, have ever been on intimate terms with albatrosses, which fact makes Mr. Alfred M. Bailey's latest article a matter of especial interest. This account, which will appear in the next number, is about these wanderers of the sea, and we feel sure that our readers will be as interested in what Mr. Bailey has to say as we ourselves have been.

JUST how many fishermen there are in these United States, we have not the slightest idea. Occasionally, however, judging from the number of inquiries that come to the American Museum's Department of Ichthyology about fish, we are inclined to estimate the number is figures almost astronomical. And most of these questions, it seems to us, have to do with the size of fish. And now Dr. E. W. Gudger has written an article about the largest of the world's fresh-water fishes. Just at present we will not say what fish that is, but will leave the question unanswered until the next number, of *NATURAL HISTORY*, when Doctor Gudger's article will appear.

THE COVER PAINTING

"AFRICAN Elephant," the cover painting of this issue, is from an oil painting by Lynn Bogue Hunt. This great animal differs in many ways from its Indian cousin, perhaps most noticeably in the size of its ears, the shape of its head, the contour of its back, and in the two finger-like processes at the tip of its trunk. The Indian elephant has only one. Rarely are African elephants seen in zoos or circus menageries, though occasionally they have been obtained for such purposes. The dominating feature in the Akeley African Hall, which is now being prepared for exhibition at the American Museum, will be a small herd of these magnificent animals, the last of which were collected last summer by F. Trubee Davison, President of the American Museum. The leading article in this issue of *NATURAL HISTORY* tells of the expedition that obtained them.



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THE LINDBERGH PLANE

"Tingmissartok," the airplane in which Colonel and Mrs. Lindbergh flew to Japan and China and in which they carried out their extraordinary survey of flying routes across the North and South Atlantic, is shown hanging in the Hall of Ocean Life at the American Museum. The cases below it contain portions of the plane's equipment, while in the background is the magnificent Coral Reef Group, which, after seven years, is now approaching completion

(See Pages 195-197)

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ELEPHANTS, LIONS, AND AIRPLANES

Collecting and Studying Wild Life in Kenya Colony and Tanganyika
with the Aid of Man-made Wings

BY FREDERICK TRUBEE DAVISON

President, American Museum of Natural History

THE prologue of the African expedition undertaken by Mrs. Davison and myself last summer began in the trophy room of my father's home almost twenty years ago, where I first became interested in the "Dark Continent" through the enthusiasm of my father.

This interest was increased by a close friend of my family—Carl Akeley—to whose tales of the veldt I listened for untold hours on his frequent visits to our house.

Akeley was one of those rarest of men—a dreamer who was able to make his dreams come true. For years he visualized a great African Hall in the American Museum of Natural History—a place where Art and Science would unite in recreating—amid beautiful, realistic, and dramatic settings—the wild life of Africa on a scale and in a manner that would be unique and unusual in the Museum world.

Mrs. Davison and I had hoped to make our African trip with Carl Akeley, but one thing or another always compelled us to postpone it. When Akeley died, we lost much of our enthusiasm. In fact, the project was allowed to lie dormant until last spring when the African Hall

Committee decided to expand the elephant group in the Hall from four specimens to eight.

After talking the matter over, Mrs. Davison and I decided that there could be no more fitting way for us to pay tribute to the memory of Carl Akeley than to contribute the four additional specimens needed for the group.

With that thought in mind, we organized our expedition and prepared a program which began simply enough but ended with a rather formidable list of objectives that ranged from antelopes to amphibians—from birds to anthropological material, plus the four elephants for African Hall.

Most of the arrangements were made for us by Martin Johnson prior to our arrival in Nairobi, Africa. Without his able and enthusiastic coöperation, our project never could have succeeded. Nor must the splendid work done by Alfred J. Klein—a former member of the Museum's staff—be underestimated. His skill as a hunter and a taxidermist stood us in good stead.

In order to save time, and in view of the fact that the Johnsons own two airplanes, Mrs. Davison and I planned to do a great deal of flying. To that end we were accom-



A CENTRAL AFRICAN PICNIC

At the right are Mr. and Mrs. Davison; next, in order, come Lieutenant Quesada, Martin Johnson, Al Klein, Hugh Davis, and (in center foreground) Mrs. Martin Johnson

panied by Lt. Elwood R. Quesada of the Army Air Corps—a splendid pilot whose skill could be relied upon in flying over the jungles, plains, and mountain ranges of East Africa. As things turned out, the planes were highly useful. We flew some 10,000 miles and covered territory that we never could have reached without planes in the time at our disposal. Of course, we did not use planes for hunting, but they were handy in scouting for game and even more worth while as time savers in going to and from our base camps.

We arrived in Nairobi after an unforgettable journey. The unforgettable part began long before dawn on July 2nd when we bumped in a cab through the dark streets of Cairo to the flying field and climbed into the weekly Cairo-Capetown plane of the Imperial Airways, aboard which we were to spend three days until we had covered the 3000-mile journey to Kisumu. There the Johnsons were to meet us in one of their ships and shuttle us over to Nairobi.

I never knew that flying could be so

exhausting. For three days we were in the air from just before dawn until just before dark, with intermediate stops for good measure. What with rough air and blinding sun aloft, plus terrific heat on the ground, that part of the journey almost wore us to a frazzle. But if anyone must travel overland through Africa, there is no better way of going. The ships are safe and the service is excellent.

However, our discomforts were forgotten when, on the second day of our southward flight, we beheld our first elephant herds. The pilot, who had seen them in the distance, came close to the ground and flew directly over the heads of several hundred elephants which did not pay much attention to the plane.

That was our first thrill. The second came the next day en route from Kisumu to Nairobi when we flew over a lake, — that is, we were told it was a lake. We could hardly see the water because the surface was covered by thousands upon thousands of flamingoes—a carpet of feathers that ranged in color from the

faintest of pastel pink to flaming red.

Two thrills like that are almost enough in any one week, but the third came that evening in Nairobi, a town which we had pictured as one of the last outposts of civilization. At dinner that night we had fish, turkey, fresh vegetables, fresh strawberries, and ice cream. It seemed a miracle rather than a dinner, until we came to know Nairobi better. We soon learned that it is a place where you can get nearly everything you want from Bond Street clothes to Paris frocks.

Throughout our stay in Africa we were the guests of the Martin Johnsons. Thus, we not only had the advantage of their wide experiences on our various sorties by air or truck, but also enjoyed the hospitality and comfort of their charming home.

Among our many friends in Nairobi one of the most thoughtful and helpful was Captain Archie Richie, game warden of Kenya Colony. He is a great friend of the American Museum and did everything he could to insure the success of our expedition.

Our project fell into two major parts:

First: To obtain four additional elephants for the Akeley African Hall.

Second: A visit to Tanganyika to photograph family life among the lions.

Linked to this program were plans to get the specimens already referred to for various Museum departments.

First came the elephants.

Captain Richie suggested that we go to Makindu, about one hundred miles from Nai-

robi, where a herd of shamba elephants had killed natives and ruined property. These outlaw elephants were marked for execution, and Captain Richie told us that we would be performing a public service by exterminating them.

We hurried to Makindu, but found that the herd had left for parts unknown. Not a single shamba elephant remained, but we did come across an old man and a little boy who sat near the wreckage of their hut in a native village that looked as if it had been hit by a cyclone. The night before an elephant herd had invaded their home. When the old man tried to run off, one of the beasts struck him with its trunk and injured his leg. He and the boy were lucky to have escaped death. Just before we left Nairobi, word came that a native, who was driving two donkeys through the brush, had encountered an old bull. The man, fearing the elephant would kill the animals, tried to frighten it away, but the beast charged, and that was the end of the driver and the donkeys.



BIG GAME TERRITORY

The lines and arrows indicate airplane flights made by the Davisons on their various safaris

From Makindu we moved to the Tana River, a famous stamping ground for elephant hunters. However, our problems differed greatly from those of the ordinary Nimrod of the bush. Usually, the elephant hunter seeks big bulls because he wants their ivory. These animals usually travel alone or in twos or threes. After a single glance, the hunter knows whether he wants one of these particular bulls or not. His problem is not complicated by the presence of a herd.

Our case was different in that we did not try to bring home the biggest elephants with the largest tusks. We had to collect specimens for a cross section of a herd and needed two average-sized bulls and two cows. But we did not want to shoot a cow with a calf, as that would have deprived a baby elephant of its mother. This made the matter quite difficult, because the youngsters, funny little things full of life, dash back and forth and make it hard to determine which cows have calves. We could be guided only by the interest various females showed in the

youngsters and we left such cows alone. This could not be done in a few minutes.

Throughout periods of stalking, the herds are usually more or less restless. The beasts seem to sense trouble without knowing just what or where it is. On one occasion a tiny calf saw us. It was no taller than a good-sized dog, and romped toward the thicket in which we were hiding until it spotted us and stopped stock still. It stared at us with intense interest. I stood breathless and saw hours of stalking gone to waste. The calf, I feared, would give the alarm and the herd would run off. But, instead, the baby flapped its ears, turned quickly, dashed toward one of the cows and stayed at its side. That was all. The old folks paid no attention to the nervousness of the youngster and never noticed us.

The types of elephant we wanted usually travel in large herds, and it took hours of careful observation at close range in extremely thick bush to find what we needed. Methods of hunting have changed considerably as a result of



TRAFFIC REGULATIONS IN AFRICA

The long arm of the law as personified by a Nairobi traffic policeman



A MODERN MUSEUM EXPEDITION TRANSPORT

The thoroughly up-to-date safari is really a cavalcade of motor trucks

the advent of motor trucks and planes. We would fly from Nairobi to our base camp and send motor cars ahead with our camping equipment. When actually hunting elephants, the procedure was to start off in a truck at daybreak over what could hardly be termed a road but which was really automobile tracks paralleling the Tana River at distances varying from a few hundred yards to three or four miles. Our trackers, riding inside or on top of the trucks, would scan the road on both sides and look for fresh elephant spoor. On finding it, the trackers would follow the trail while we waited for reports.

A typical experience was our last one. The spoor of a herd of some dozen elephants was located about six o'clock in the morning. At seven o'clock one of the three native trackers returned and told us that the herd had been located. An hour later we reached the two trackers who had stayed with the herd. We found them in thick and thorny bush which was so dense that, although we were frequently within ten or fifteen yards of the herd, we caught only occasional glimpses of the animals as they plowed through the

thicket, breaking down trees and flattening out bushes as they moved about.

Our chief tracker, Mafuta, a Wakamba native, directed the stalk. He was followed by Klein. Inasmuch as I was to do the shooting on this particular occasion, I stayed close to Klein and was followed by Mrs. Davison with the camera. Next came Quesada. For five and a half hours we watched that herd and during all that time the animals did not move more than three miles.

There is one thing of which I am perfectly certain: namely, that there is nothing more exciting than that kind of an experience. Elephants look big in a zoo, but in the bush, with nothing but a rifle bullet between them and the hunter, they are colossal. Until I met them eye to eye, I thought those towering beasts would stand out like skyscrapers, but I was wrong. You can hear them when it is impossible to see them. But they can be quiet, too. When on guard, an elephant can be as still as a mouse, but, ordinarily, he crashes through the bush like an animated tank. Nor are elephant herds constantly on the move. They frequently

lie-up in the middle of the day and rest for several hours. On numerous occasions we would leave a herd, go to lunch, return and find the animals exactly where we had left them. When elephants feed, they move along slowly. But when they are alarmed, they disappear at great speed.

In addition to keen and trained eyes—provided by native trackers—caution is essential. Elephants are ever alert. Hence, it is necessary to watch the wind carefully. Mafuta always would carry a handful of dust, and every two or three steps he would throw a pinch or two into the air to be sure there were no eddies or a change in the wind that would carry our scent to the herd.

It was almost two o'clock on this particular day before Al Klein made up his mind that one of the cows in the herd was of the right size and that she had no calf. She finally presented a target at a range of about sixty yards and we brought her down.

I did not feel the slightest thrill of elation. On the contrary, my reaction

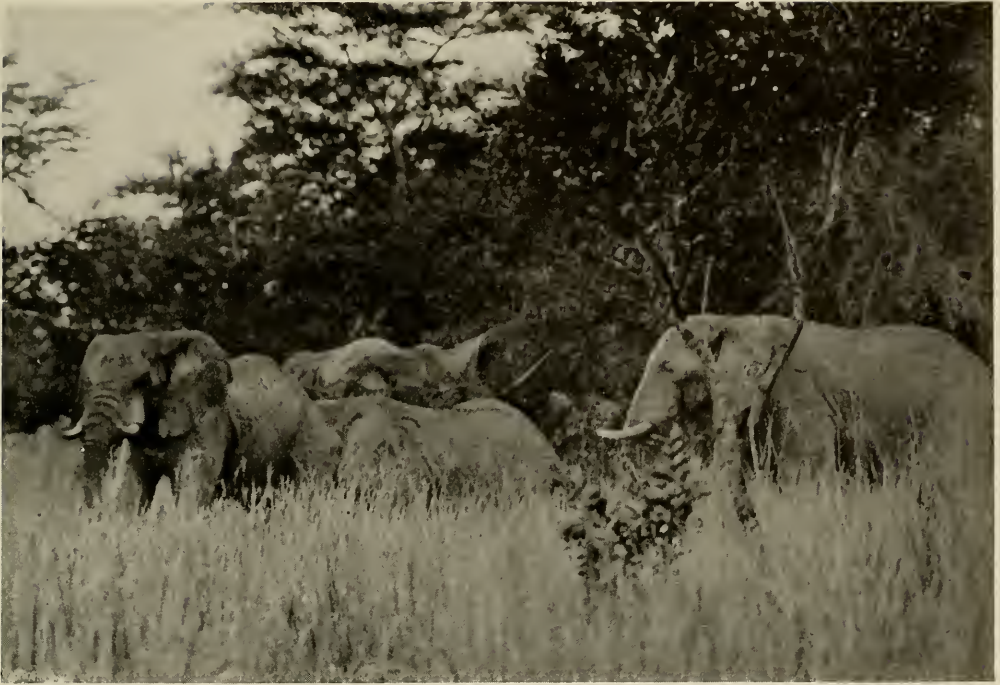
was one of regret. First came a feeling of relief that the incident was over and that no one had been hurt. Then, as we walked up to the elephant and saw the magnificent animal lying lifeless on the ground, I felt genuinely sorry that it had been necessary, even in the cause of science and education, to kill such a splendid beast. Certainly, I would never shoot an elephant for a trophy. After all, it is unique in the world today—the last remnant of the giants that roamed this globe centuries ago. So far as we were concerned, I think we got more real thrill out of hunting with cameras than with guns. We used more films than ammunition. For instance, I think I fired less than fifty shots throughout the entire expedition, but I “shot” at least 2000 pictures.

After the elephant is downed, the hunter's troubles are over and those of the skinners begin. Klein had recruited a staff of experienced skinners, rare and valuable fellows. It is easy enough for a sportsman to remove tusks to be mounted in a trophy room, but quite different to take



TEMPORARY HEADQUARTERS

In shelters such as these the Davisons and their party camped while in quest of elephants



RESTING

This magnificent group of elephants was photographed by Carl Akeley in Africa when he was engaged in collecting and planning for a future African Hall for the American Museum

the entire skin of an elephant, prepare it for museum exhibition, and ship it to America. That job requires not only much labor, but also a vast amount of technical experience. Luckily Klein had plenty of that.

Watching the skinners at their gory task is interesting but somewhat revolting. As they reach the carcass, they sing, sharpen their knives and, in general, give an appearance of joyous anticipation of the work at hand. The skin is removed in one piece, and that part of the chore takes hours of careful cutting. Next, the skin, unwieldy and heavy, is loaded on a truck. At times it would take from twenty to thirty men to do that. Back at camp, after it has been sufficiently thinned down, the skin is soaked in brine for many hours and then salted for shipment. The number of elephant skins that have been preserved complete is so low that handling them is

still an experiment. It was therefore a great satisfaction to all of us when, after the hides arrived in America, we found that Klein and his natives had done their work in a most satisfactory manner.

In addition to the elephant hides, bones, and brains, the scientific staff of the Museum wanted an elephant foetus. Klein told me that our hunting had been the most difficult and dangerous that he had ever known, and added ruefully that the only way in which our task could have been made more difficult would have been for the staff to have specified the sex of the foetus. Unfortunately, neither of the two cows that we took provided the Museum with this much-to-be-desired addition to its collections.

We were on the Tana River about four weeks and obtained one small bull, one medium-sized bull, one small cow, one medium-sized cow, and then, unfortunately, we were forced to shoot a bull



ON THE SERENGETTI PLAINS

Herds of buffalo browsing in the foot-hills near Mt. Kenya. The only shots taken at these fine animals by the Museum party were camera "shots"

Tanganyika, Klein took us up to Embu in the foot-hills near Mount Kenya. There we found large herds of buffalo and a considerable number of rhinos, none of which we shot.

Following an overnight stay in Nairobi, we

that charged us. We made every effort to divert the attack, but had to kill him in self-defense. Hence, we ended up with five elephants instead of four, which means that the group in Akeley African Hall will contain nine specimens instead of eight.

On the Tana we collected game birds, reptiles, and specimens of antelope, such as gerenuk and Hunter's hartebeest. The last are quite rare and hitherto not represented in the Museum. We found them in a strip of country about twenty-five miles wide which runs from the Tana toward Italian Somaliland. They are fairly plentiful in this restricted area but are not to be found elsewhere.

While neither Mrs. Davison nor I wanted to take any buffalo or rhino, we were anxious to see these famous so-called dangerous game animals, and between the Tana safari and our next one in

started for Tanganyika—not to hunt but to watch the Johnsons do their photographic work and to "play with" the lions. I had heard much about this newest of big game sports, but cannot adequately describe it. After flying down to the Serengetti Plains, where our native boys had pitched camp for us, we started out the next day in search of the king of beasts.

Before we had gone two or three miles, Mrs. Johnson spotted a lioness which sat on her haunches in the tall grass and looked at us with the bland indifference of a large and lazy cat. I was in front with Mrs. Johnson, who was driving; Mrs.

THE FAVORITE TITBIT OF THE LION

The giraffe is not only swift, but so cleverly camouflaged by nature that it is almost impossible to distinguish it among the trees



Davison sat in the rear with Johnson and Quesada. Johnson's trucks are equipped with movable tops, which is very advantageous from a photographic standpoint. We were about fifteen yards from the lioness and it seemed to me that we had gone about far enough. In fact, I clutched my rifle a little tighter. Then Mrs. Johnson stopped the car and the cameras began to click. I was beginning to feel at ease when, much to my horror, Johnson suggested that we go still closer. This we did, and drove up to within about thirty feet of the animal. But she sat where she was, showing sublime unconcern, evidently not caring a fig whether we stayed or went. After half an hour or so of posing before our cameras, she slowly got up and walked off. This was my first real contact with a lion and provided me, as I am sure it would anybody, with a combination of goose flesh and amazement.

Further experiences of the same sort during the next three weeks rather eliminated the goose flesh, but I never could bring myself to forget that we were playing with animated dynamite that might blow up without notice. Hence, our rifles were always ready for instant action.

Lions, of course, live on the so-called plains game—zebra, wildebeest, topi, and hartebeest. Therefore, when such game is to be found, lions are likely to follow. Where game is scarce, lions are few and far between.

This last summer the rains which ordinarily fall between March and June did not materialize. That meant a scarcity of green grass, and as a result—so the Johnsons and the natives told us—the game was nothing compared to what it should be. Consequently, they were

disappointed in the number of lions we saw, but we were thoroughly impressed. When you sit within a few yards of whole families of lions, watch them eat, play and sleep—what are a few lions more or less?

Within a mile of our camp lived a group of about fourteen lions, every one of which we came to know intimately. We fed them practically every day and they came to regard us as reliable meal tickets. In

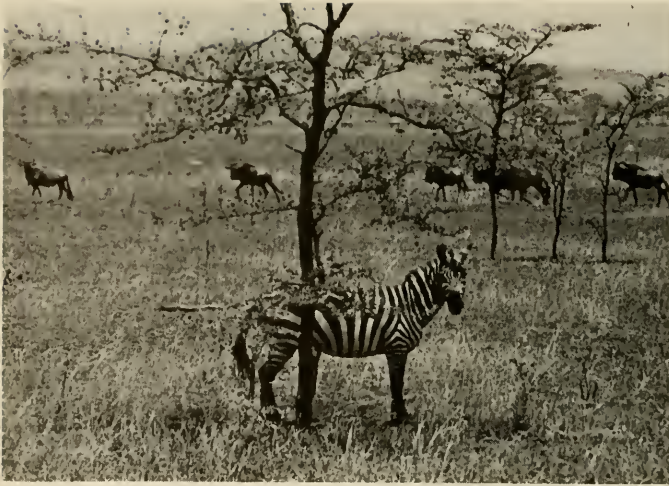
fact, they were obviously disappointed whenever our car drove up and failed to bring food. As we approached, they would come out of the donga in which they lived and lumber toward us at a slow pace. If the food were there, they paid no further attention to us, but started right in on their meal. Otherwise, they would lie down again at distances ranging from ten feet to fifty yards, looking very hurt, very bored, and hoping for better times later on, I suppose.

No one will ever know why lions are indifferent to man when confronted by him in motor cars. It seems to me that the most reasonable theory is that, since they have no enemy except man, they must regard the automobile as another



IN FULL FLIGHT

A flock of ostriches streaks across the plains in front of the Davison party at almost a mile-a-minute speed



GRASS COUNTRY

The veldt, with its abundance of game, acts as a well-stocked larder for the lion

too young to eat meat, and parked them under a tree some distance from the supper. Eventually another lioness brought them a tit-bit. This they chewed with great enthusiasm. The mother looked on for five minutes or so, then she took the meat away from the cubs, buried it—and that

animal and therefore treat it with disdain and contempt.

We photographed dozens of lions, several of them lying almost under the car. We followed them for hours as they moved about. It was not a case of stalking, because we were perfectly visible to them all the while. At times we would sit on the top of the car and even call to them in loud tones. The human voice seemed to put them on their guard, but any feeling of uneasiness seldom lasted long. They might rise up, lift their ears, and look around. A few seconds later they would go back to whatever they were doing before they were interrupted. Now and then the younger lions would jump up and dash off, only to return shortly. The family life seemed happy and well ordered. The mothers always let their cubs eat before they took any food themselves. One attentive mother with very young cubs evidently thought they were

was that. We never saw the slightest sign of temper among the lions nor did they even seriously resent our presence. Nevertheless, there is no doubt but that lions can produce plenty of spleen when they have good reason to do so.

Our experiences in "playing" with lions were so fascinating that we were quite heavy-hearted when it was time for us to return to Nairobi and the States. It was with regret that we left King Leo, his ladies and his cubs, but we hope to see them again some day.

Someone has written that "he who drinks of Africa's waters will drink again," and I for one am prepared to

THE BANQUET

One of the groups of lions which came out every day to be fed by the Davison party



accept that statement without qualification. Africa is one of the few remaining places on earth where wild life exists in abundance and where living conditions are not only pleasant but extremely attractive.

It is a land of contrasts, and one of its most amazing ones is that you may travel "through the blue" with nothing in sight but wilderness and then suddenly stumble upon a landing field for airplanes. Not airports as we know them, with hangars and other facilities, but flat, cleared spaces, kept smooth by natives under the supervision of district commissioners. My air travels in Africa demonstrated the all-round usefulness of the plane. I am not an explorer, but I have followed men who, like Akeley, have gone into the little-known sections of the world, and I believe that the advancement of flight as represented by increased speed, greater safety, and reduced costs of operation will put scientific exploration on a new and improved footing. We used planes in going to and from our base camps, and covered in two hours distances which it took our equipment five days of difficult travel by truck. The landing fields we used were not built to promote air travel but were for the use of military planes in case of trouble with the natives. I know one district commissioner who has jurisdiction over a very troublesome tribe. He never knows when he may need military help. He is far in the interior, but fighting planes can reach him in comparatively short time.

The natives are not afraid of planes, but while they do not fear them in the air or on the ground, they are deadly afraid to fly. On almost every flight we



NONCHALANT

This lioness, very curious and not at all querulous, posed for more than half an hour in front of the camera before she became bored and left

had two or more natives along and they were not at all air-minded. As a matter of fact, one of our ablest trackers left us because he flew once and was afraid that he might have to do it again.

Perhaps the natives will change their air views as time goes on. All things change, even Africa. The "Dark Continent" of Stanley's day became the "Bright Africa" of Akeley's time, and probably the period is not remote when cities and plantations will conquer nature and primitive life on the veldt. Some say that there is less game than there used to be. I do not know if this is true, but I do believe that the game will inevitably disappear from many regions. Sportsmen will not be primarily responsible for this.

The situation in Africa is, I believe, similar to our own in this country. Years ago huge herds of buffalo and other



A MODEL OF THE ELEPHANT GROUP

Showing it as it eventually will appear in Akeley African Hall of the American Museum of Natural History

game roamed the western plains. Today the herds are almost gone, and it is the advance of civilization that has destroyed them. The same is bound to happen to Africa, and that is why it is so important that our educational institutions make available for millions of people who never will see Africa, as well as for the generations that are to come, an accurate, beautiful, and instructive picture of

African wild life, before it is too late.

I am proud to predict that, of these, the Akeley African Hall of the American Museum will be the finest of its kind—a memorial to a frontier that won the hearts of men such as Roosevelt, Akeley, Eastman, and others who now have left the veldt and its golden joys to go on that last great Safari from which no hunter returns.



ONE OF MARTIN JOHNSON'S AMPHIBIAN PLANES LANDING ON AN AIRDRONE PREPARED BY THE BRITISH GOVERNMENT



Temple, Nahua Style, Santiago Huatusco, Vera Cruz. After Du Paix, 1834

THE ARCHITECTURE OF PRE-COLUMBIAN CENTRAL AMERICA

Being the First of a Series of Six Articles on the Major Artistic Accomplishments of
Central American Native Civilizations

By GEORGE C. VAILLANT

Associate Curator of Mexican Archaeology, American Museum

THE art of Central America is as baffling as it is impressive. Completely a product of the Indians of the New World, it cannot be fitted into the customary canons of European æsthetics. The higher expressions of Central American art are far from primitive, but the modern American, missing the emotional appeal which characterizes his own art, feels that there is something undeveloped in that of Central America. Yet the same man would not hesitate in his appreciation of an unemotional art like the Egyptian, because it has a definite place in the history of his own artistic development. To introduce to our readers the civilizations of Central America, we have prepared a series of six articles on their architecture, sculpture, painting, dress, jewelry, and pottery.

These subjects are to be treated from a general point of view, suppressing as much as possible the details of time and tribe. However, without some knowledge of the historical background, the living quality of the art is lost.

The first immigrants from Asia entered America by way of Alaska toward the close of the last glaciation, and this infiltration of peoples probably continued up to the time of European colonization. Since no traces of Asiatic civilization are found in North America the cultural plane of which is relatively low, there are no good grounds for assuming that these immigrants brought an art with them. At some time during this population of the New World, groups of people in Central and northern South America began to develop an agriculture based on



Photograph by LaRochester, Mexico

PYRAMID OF CUICUILCO, VALLEY OF MEXICO

This oval structure of adobe studded with uncut stone is completely surrounded by the lava flow at the left. It is probably the oldest building in Central Mexico

native plants like corn, potatoes, and manioc, which were unknown to the Old World until after the discovery of the New. This food supply is one of the most important proofs that the New World civilizations were uninfluenced by those of the Old. A contact with the Old World close enough to permit absorption of its art styles would also utilize its food plants and domestic animals.

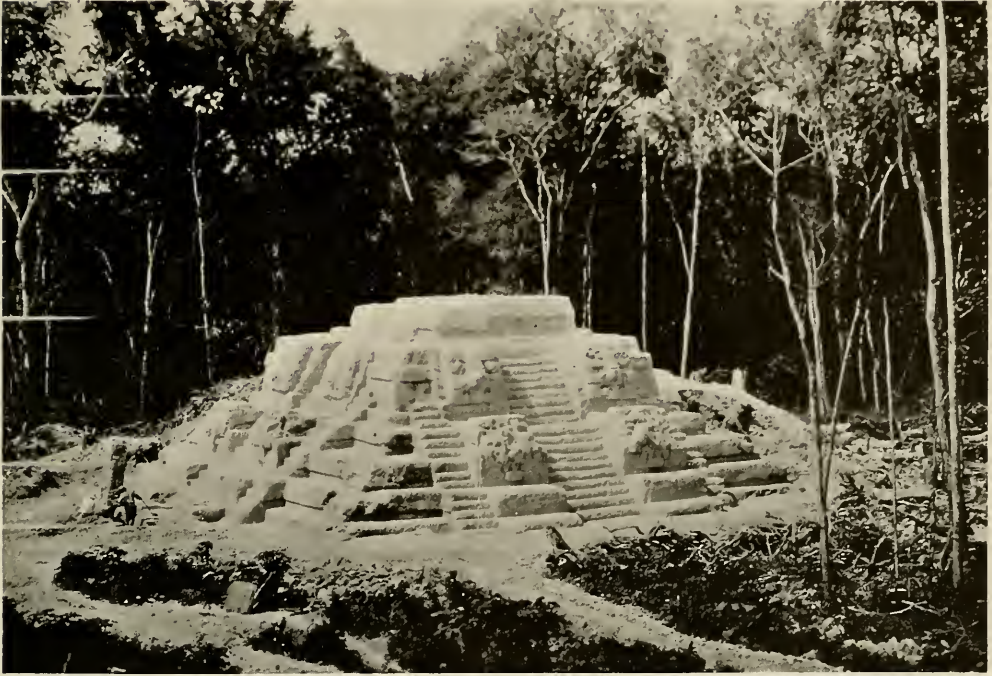
Once a stable food supply was assured them, the tribes in Central America had an opportunity to develop their culture. Perhaps more conscious of the novelty of

agriculture than the Asiatics, the Central Americans worshipped those natural forces which controlled the harvest, and evolved a religion in their honor.

The broken mountainous country stretching from the Rio Grande to Panama has several distinct climates, according to the altitude. Great forests and mountains tended to isolate inhabited communities. Consequently small groups of people could retain their language and develop dialects as well as evolve distinctive customs and art forms. Some of these tribes developed most sophisticated civilizations, while others lagged, retaining a primitive culture. To thread our way through the tortuous mazes of the cultures of these tribelets is beyond our purpose, nor have we the knowledge to do so even if we wished.

Two major artistic developments can be discerned, however, the art of the Maya-speaking people of the low, hot country of Guatemala and Yucatan, and that of the Nahua tribes of the Mexican Highlands. Combinations and transitions between Maya and Nahua art may be seen in the civilizations of the tribes in adjoining regions. Maya art is the æsthetic of a gentle people, whereas Nahua art is the product of a more austere and warlike folk.

The period of Central American art covers the first fifteen hundred years of the Christian era. Previous to that time



Photograph by S. C. Morley

TEMPLE EVII SUB, UAXACTUN, GUATEMALA

This oldest Maya building yet found is made of rubble with a plaster covering. It is a platform without any trace of a temple. Note the masks carved at the sides

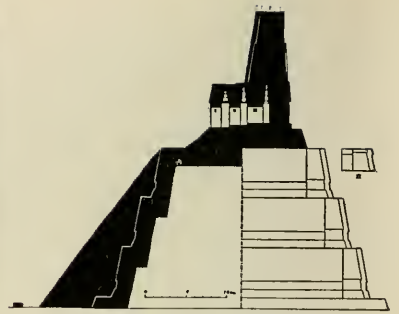
the tribes of Central America were making the slow climb from a hunting stage and inventing agriculture anew, while some of the Old World nations had already embarked on the preliminary stages of civilization. The Maya seem to have been first to produce a really fine art in Central America, but, by the Tenth Century, the Nahua had also developed a concrete æsthetic expression. While in the first ten centuries of the Christian era the Maya were artistically predominant, they afterward began to decline, so that at the time of the Spanish Conquest in 1519, Nahua tribes, like the Aztec and Mixtec, produced the major examples of Central American art.

Having roughly oriented ourselves in time and space, we can now examine the various expressions of Central American æsthetics. We can appreciate a little more clearly the circumstances under which groups of people, without steel

tools and without draught animals, were able to create a civilization that glorified not themselves but the gods who permitted them to exist. Living in subservience to their divinities, the Central Americans seemed little interested in their own emotional weaknesses or sentimentality, and this impersonality, often austere, defines their art.



Architecture, more than any other art, symbolizes the pitiless quality of Central American civilization. However, as coldness also characterizes our own modern buildings, the architecture of the ancient Mexicans and Mayas gives us the most comprehensive approach to their art. We can also understand, since the major architecture of Central America is dominantly religious, how ritualistic and ceremonial requirements permeate the other arts like sculpture, painting, textiles, jewelry, and pottery.



TEMPLE II, TIKAL GUATEMALA,
MODEL AND SECTION

The decorative emphasis has passed from the platform (p. 119) to the temple proper. The rooms are mere slits in the solid masonry mass supporting the roof comb on which decoration is concentrated. It can be readily seen that the basic idea is to construct a monument rather than a place to house a congregation. Temple II is one of the oldest Maya religious structures, and illustrates one of the fundamental principles of the religious architecture. The succeeding photographs trace the evolution of religious monuments like this into temples. Section after Maler, 1911

Religion was the most vigorous social force in Central America. Priests, not chiefs, governed the various tribal groups, and these hierarchs were ever conscious that they must placate the gods who controlled all natural phenomena. This philosophy caused the tribal leaders to organize ceremonies and establish places of worship in order to cultivate the favor of their divinities. Religious demands so completely absorbed the surplus energy of the Central American people, once they had met their needs for subsistence, that, except in the highest civilizations, one can discern few traces of specific civil government.

Under such conditions it is not surprising that the ceremonial architecture was tremendously developed, while dwelling houses, made of adobe or wattle and daub, were of the simplest nature. Only the Aztecs and their neighbors in the Valley of Mexico seem to have produced a

domestic architecture at all complex. Discussion of the artistic evolution of architecture naturally centers around the buildings used directly and indirectly for religious purposes.

We do not know the point of origin for Central American architecture, or whether it had been evolved at a single place or in several. But the most common type of ruin comprises a group of mounds, set sometimes around a central plaza, sometimes without an obviously formal plan. Quite commonly in the mountainous regions collections of mounds are strung along ridges or mesas, which have been graded to provide level surfaces for living and to give a solid basis for the erection of platforms. Very often these terraces and substructures were faced with stone over a hearting of adobe or rubble, when a suitable quarry was readily accessible.

The ground plans of Central American cities differ, but in two respects only,—formal or informal grouping. Yet, the arrangement of the plan seems to depend

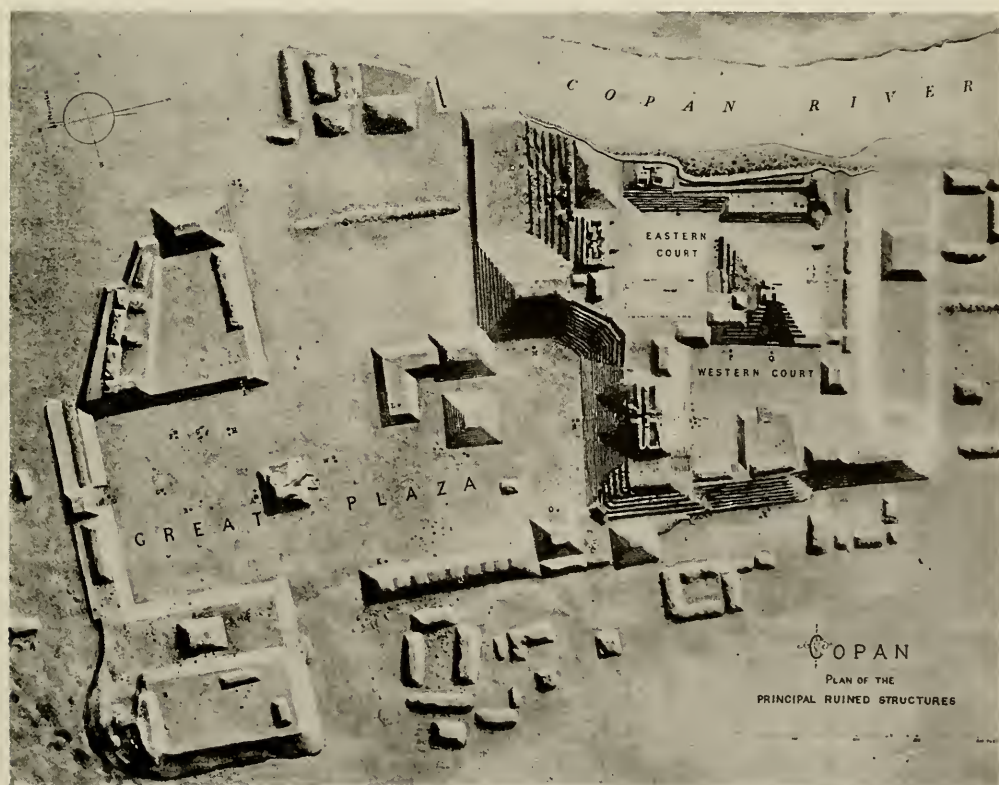
on local conditions of terrain or order of construction, rather than on the scale of cultural evolution. The architecturally very developed Chichen Itza has a haphazard distribution, while the older and structurally much simpler Teotihuacan is most elegant in its orderly design.

Preservation is an extremely important factor in our estimates of architectural values. The stone-faced temple of Yucatan which has resisted the elements seems to us more worthy of admiration than the battered adobe or rubble buildings on the Mexican Highlands which have capitulated to the elements. For all we know there may have been superb buildings of wood representing an interesting and imposing architectural order which, being incapable of preservation, is lost to us. We cannot, then, judge build-

ings en masse, but must trace by individual temples the course of Central American architecture.

The fundamental idea in Central American architecture was to create a focal point for ceremonies which took place outside the building. The temples were seldom intended to *house* congregations, as were the cathedrals of Europe or the great temples of Egypt, nor in shape or purpose do they resemble those colossal mortuary chambers, the Pyramids. Maya and Mexican ceremonial structures were true monuments to the glory of the gods.

In view of this dominant interest, the constant enlargement of buildings is not surprising. Moreover, in several regions, the termination of a fifty-two year cycle was the occasion for renovating all possessions, ceremonial and personal, even



RELIEF MAP OF COPAN, HONDURAS

Showing the plan of this ancient Maya city. Note the amount of grading done before construction of buildings began. After Maudslay, 1899



THE GATEWAY AT LABNAH, YUCATAN

A magnificent example of northern Maya architecture. The corbel vault is composed of overlapping stones which are supported by the weight of the masonry above, and are not united by a keystone, as in the true arch. Photograph by the Department of Historical Monuments, Mexico

to the destruction of household articles used up to that time. This aggrandizement was accomplished in two ways. The simpler method was to build over the original structure, filling in the temple and adding to the platform until both were converted into a foundation on which a new temple could be erected. Due to this custom many buildings that would otherwise have been lost are now preserved within the sheathing of the later additions. The second way was to add a wing or an ell to the original structure, a method of addition well known to us today. Sometimes the two methods were combined.

The two oldest buildings known to us in Central America were platforms, probably without temples. One of these is the oval mound of Cuicuilco in the south of the Valley of Mexico. This was built of adobe bricks arranged in several ascending terraces, and two staircases were disposed at either end. The outside of the

structure was faced with river boulders, over which a later enlargement had been made, utilizing lava blocks as a veneer. An altar in horse-shoe shape surmounted the earlier building, but no trace remains of whatever construction crowned the later mound. While it is possible that this earlier altar was enclosed, its size and shape suggest that it was built in the open. The antiquity of Cuicuilco is incontestable, first because a lava flow surrounded the building after it had been abandoned, and second, because the associated objects tie in with the remains of one of the Early Cultures of the Valley.

The other temple, EVII-sub, at Uaxactun in the heart of the Maya country, was a quadrangular structure of rubble coated with a thick layer of plaster. Stairs ascended the sides, flanked by broad buttresses carved into grotesque masks. There was no trace of any construction on top of the platform. The

CHICHEN ITZA, YUCATAN

In this panorama of a late Maya city, may be seen how formal ground plan was seldom a primary consideration with the Maya. The temples of the Mexican period in the background show a more orderly arrangement than do the Maya buildings in the foreground. After Holmes, 1895



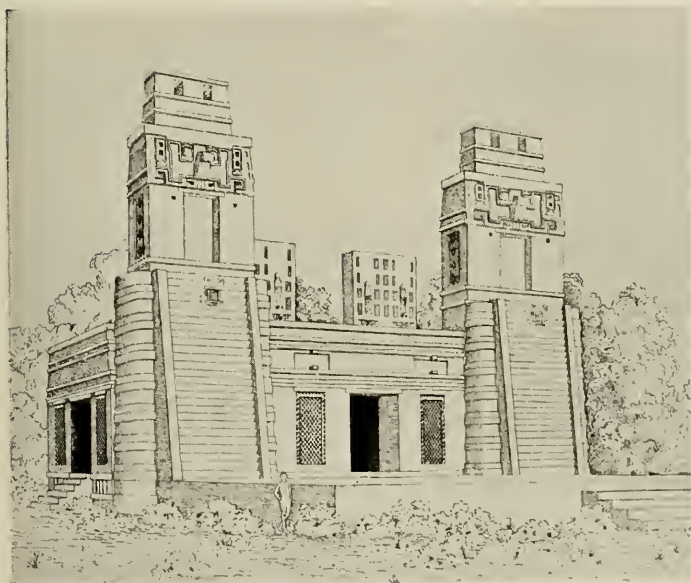
preservation of this perishable structure was accomplished by a later platform which effectively sealed it from destructive natural agencies, such as roots and rains. That temple EVII-sub is of substantial antiquity there can be little doubt, as the outer building was associated with some of the earliest time-markers found in the Maya area.

Both of these early structures were platforms, not temples. The underlying idea was definitely to attain elevation, and thus to dramatize the ceremony. The open summits show that there was no idea of enclosing the ritual, so that temple construction must have been a secondary factor. Already we can discern in the carved surfaces of the Uaxactun temple the Maya preoccupation with design, and in the unadorned surfaces of Cuiculco

the Mexican emphasis on mass and treatment of planes.

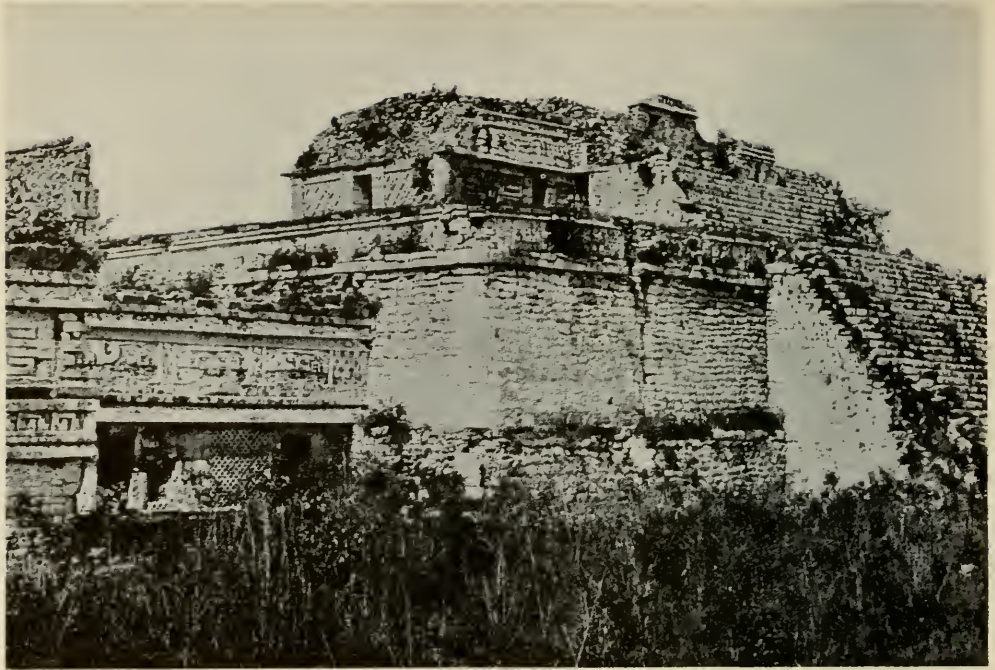
The need of a place to house the image of a god must soon have made itself felt, and soon the custom of a temple or shrine surmounting the mound must have arisen. The earliest Maya temples preserved were of rubble faced with plaster, and were intended to be seen rather than used. The carving which had embellished the side walls of the platform, as at Uaxactun, was transferred to the temple, leaving the substructure bare. To receive this decoration a masonry block was built on the roof, but the weight of this mass necessitated extremely thick walls to support it. Furthermore, the Maya used a corbel or false arch, incapable of bearing a heavy weight. As a result we find massive buildings with rooms only two or three feet wide.

In time the Maya learned how to lighten the burden of the roof-comb by rearing a narrow perforated wall directly above the partition walls of the temple. By so doing, no weight fell directly on the arch of the roof, and it became possible to



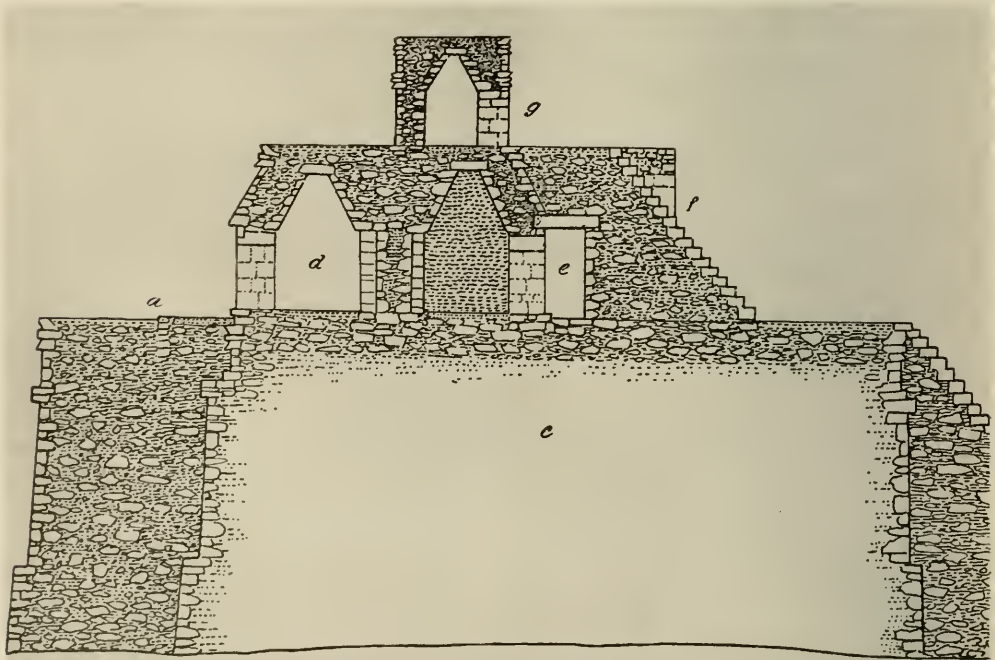
TEMPLE AT RIO BEC,
QUINTANA ROO

This Maya temple shows the transition from a religious monument to a shrine with usable rooms. The towers are conventionalized reproductions of the Tikal type of temple (p. 120), while the building proper is not unlike the Yucatan structures shown above and on page 124



THE "NUNNERY," CHICHEN ITZA

A building of Yucatan Maya type (see also p. 123, upper). Stone is used as facing and elaborate ornament relieves the outer surfaces. Note how this solid construction resists decay and renders possible an accurate appraisal of the architecture. After Totten, 1926



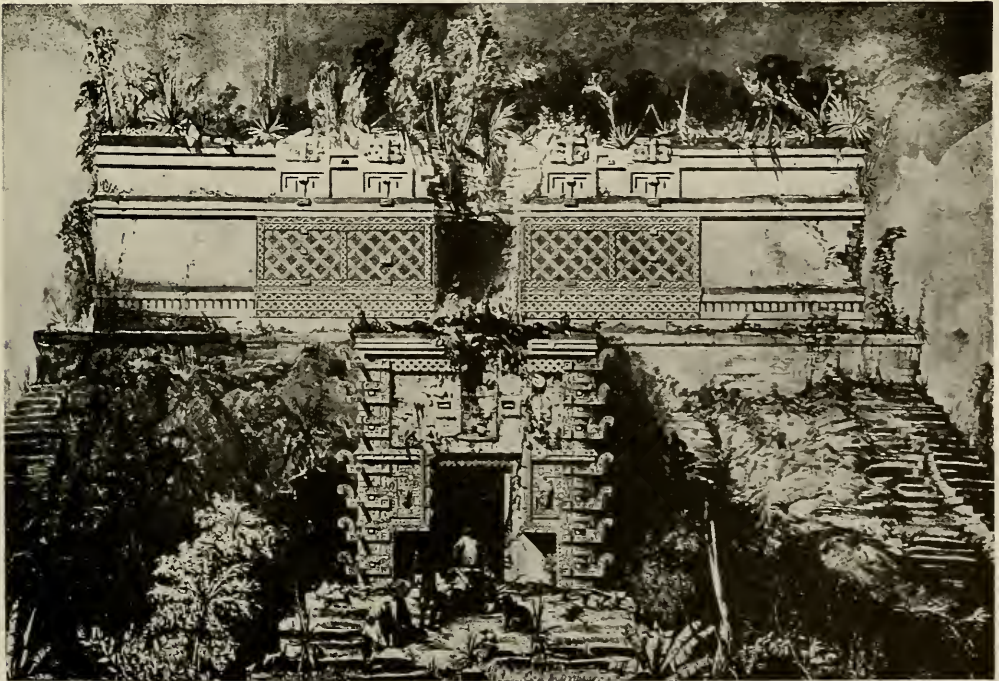
CROSS SECTION OF THE "NUNNERY"

Showing structural detail and method of accretion. The platform, *c*, was built to add a second storey, *d*, to the wing at the left of the photograph above. The third storey, *g*, reached by the stair, *f*, was added later, after filling in one rank of the *d* series of rooms. After Holmes, 1895



THE CASTILLO, CHICHEN ITZA, A MEXICAN PERIOD TEMPLE

Showing this foreign influence in the dramatic treatment of the stair and the serpent columns and balustrade. The Temple of the Warriors, a notable companion building, is shown in *NATURAL HISTORY*, Volume XXXIII, p. 618. Photograph by Department of Historic Monuments



HOUSE OF THE DWARF, UXMAL

Compare the ornate treatment of the ornament on this Maya temple with the simplicity of the Mexican-influenced Castillo above. Note how the portal represents a serpent mouth. Totten, 1925, after Catherwood, 1841



RECONSTRUCTION OF TEOTIHUACAN

In the Toltec city of the Mexican Highlands, ground plan is very important. The temples are grouped in precincts, which in turn are arranged in axes. After Gamio, 1922



PYRAMID OF THE SUN, TEOTIHUACAN

This central structure in the panorama above is made of adobe with a stone facing and was the foundation for a temple. Note the size in contrast with the buildings near by. Photograph by Fairchild Aerial Surveys de Mexico, S. A.

have wider rooms. Once room plan became a primary consideration, it was possible to give the rooms a more varied use instead of confining them to the support of a heavy roof-comb. At Palenque we find an outer and an inner shrine, the latter containing a small sanctuary, and at the Castillo in Chichen Itza an outer corridor surrounds the shrine. The culmination of the temple idea is the great Temple of the Warriors at Chichen Itza and its various annexes. Here the roof-comb was dispensed with, and rows of elaborately carved columns supported a series of arches. This building, strongly affected by influence from Mexico, is the most important Central American example of a temple which afforded space for a congregation within its confines.

The essence of Maya architecture may be seen in the evolution of the offering platform into a pyramid surmounted by an ornamented shrine which finally, through increased knowledge of construction, is developed into a temple. Paralleling this development is that of the associated buildings which presumably were to house the temple staff. Without the necessity of supporting an elaborate ornamental crest, the rooms could be as wide as a corbel vault could conveniently be made, a space of some eight to thirteen feet, depending on the length of the tails of the roofing stones and the height of the vault. But the long axes of the building



TEMPLE OF THE SUN, PALENQUE

The most evolved type of Maya building. Compare the wide rooms here with the narrow slots at Tikal (p. 120). Notice also the shrine in the back room, and the division of the door into a colonnade

could be indefinitely prolonged. At first these houses seem to have been composed of three or four oblong rooms fitted together to form a rectangle. Later, when size began to be more esteemed, ranks of rooms were strung together like beads.

The highest development of this kind of building was found in Yucatan. Instead of a plaster façade, the facing of these houses was of stone, which was elaborately carved. The general field of decoration was between the top wall and the roof. Now a large building of several ranks of rooms was extremely unsatisfactory, since the inner rooms were deprived of light and air. To overcome this, the idea of creating second and third storeys was



THE GREAT TEMPLE AT TENOCHTITLAN, THE ANCIENT MEXICO CITY

This building and that on page 126 show the Mexican emphasis on planes in contrast to the Maya use of ornament. The double temple is in honor of the Rain and War Gods. (See *NATURAL HISTORY* Volume XXXIII, pp. 18-19). Reconstruction by Ignacio Marquina

evolved. As we have seen in the temple architecture, it was incompatible with Maya idea of safety to support a great weight on a hollow foundation. In building a second storey the Maya usually filled in the rooms immediately beneath the projected upper floor. To keep the maximum number of rooms in use, each of the rooms was stepped back from the one below. Another method of constructing an edifice of more than one storey was to surround with ranks of rooms the platform supporting a building.

We have seen that at first the conception of an enclosed space was predominant, and that later air and light began to be considered by erecting several tiers of rooms. As a corollary of this, the simple doorway began to be split up into several portals, leading to an eventual evolution of the column. Toward the close of the Mexican occupation of Chichen Itza, the ranks of rooms so characteristic of Yucatan gave way to colonnades. Here wooden lintels strung from column to column carried the weight of the vaults.



HALL OF THE COLUMNS, MITLA, OAXACA

This is one of the largest completely walled buildings in Central America. Note the ingenious mosaic of separate blocks of stone. After Charnay and Viollet le Duc, 1862



TEMPLE AT XOCHICALCO, MORELOS

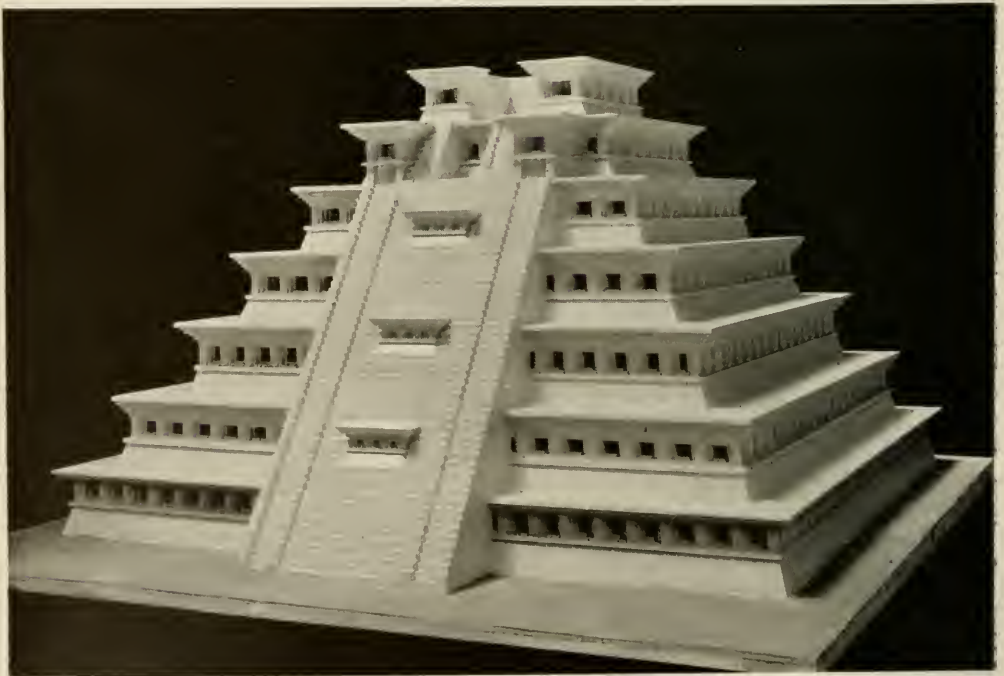
Another ornate example of Nahuatl architecture wherein the temple and platform are treated as a unit. The frieze falls into the Mixtec-Zapotec art style. After Totten, 1926

Perhaps because of accident of preservation, but more probably because of increased light, in buildings of this late period we begin to find interior ornament such as frescoes and carved and plastered columns. Unless designs could be seen, there would be no purpose in creating them, for the inner apartments of a simple collection of ranked rooms must have been almost pitch black.

The essential success of Maya architecture from the dramatic point of view was the invention of a monolithic type of construction involving the false arch, which rendered it possible to combine mass, height, and field for ornament, with inner space for the performance of cult practice. On the highlands of Mexico the basis of construction was much simpler. The false arch was unknown, and there was no such mastery of stone and concrete construction. Unfortunately, very few Mexican temples have been preserved.

In the first place, the people on the Mexican Highlands commonly used adobe and piled stone faced with cement, a type of construction that resists very poorly the destructive action of time. Instead of covering their buildings with corbel vaults, they erected flat roofs of plaster spread on beams, or pitched roofs of thatch or wood. Consequently we have no such obvious point of interest as in the miraculously preserved Maya buildings. However, one does have the impression that the effect of awe was gained by the vast, imposing mass of the substructure rather than the building on top.

Decorative treatment of the side walls of the platform was emphasized very rarely to the point of obscuring the central planes. While the most ornate frieze known from the Highland region is the deeply cut Temple of Quetzalcoatl at Teotihuacan, more often carvings like snakes' or death's-heads were inserted in



TEMPLE OF TAJIN, VERA CRUZ

As at Xochicalco (p. 129) the platform and temple are built as a unit. The apertures are small niches for statues. This temple is most readily adaptable to European architectural ideas

the walls. The major ornament seems to have been the stair which was treated as a center of interest and not as a mere communication.

The plans of the temples were not so rigidly controlled by structural factors as in the Maya area. Roofs supported by wooden beams could cover wider spaces than stone slabs inched out to meet in a corbel vault. Under such circumstances an inner and an outer chamber of substantial size could be made. Sometimes the temples had stone walls and the roofs were lofty structures of wooden crib-work. A

feature of many Aztec temples was the erection of two temples on a platform for whichever two gods in their pantheon were especially to be venerated. At Tenochtitlan there was a notable pair of shrines in honor of the Gods of War and Rain.

Palaces and priestly dwellings followed domestic architecture more closely. A number of rooms were grouped around courts, and colonnades were not uncommon. In some places, as at Teotihuacan, by using interior columns a large central room could be formed. Two-storey houses are described in accounts of Mexico, but at the earlier site of Teotihuacan, our best source for priestly dwellings, platforms were used to elevate one room above another. As in the Maya area, there was the same mistrust of using the roof and walls of one room to support another.

A blending of Mexican and Mayan architectural ideas existed at Chichen Itza and at Tuloom. At Chichen Itza

the Castillo showed a dramatic treatment of the substructure and stair, although the emphasis on the temple was in part Maya. More specifically the Temple of the Warriors resembled Mexico in the ornate friezes around the platform, and perhaps the use of the colonnade in the

temple proper.

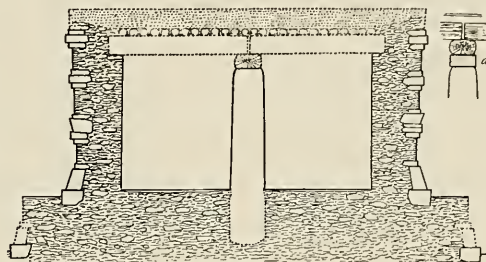
However, the vaulting and general exterior treatment are Maya. At Tuloom we find an emphasis on mass and plane surfaces, as well as the flat roof of the Highlands. Conceivably this is the ultimate southeastern swing of the Mexican school of architecture.

These types of

architecture, the Maya and the Mexican, express the two major styles of Central America. There are, however, certain other buildings which suggest the existence of different architectural evolutions.

Especially notable is the temple of Tajin near Papantla in Vera Cruz. In this case the temple was made one of the successive rising stages of the platform, thus creating a unified harmony between fane and substructure. There was no carving, although in niches set throughout the sides idols were placed; but these cannot have detracted from the essential unity of plane and mass. Another case where the temple was treated in terms of the platform was at Xochicalco. Here the planes of the building were subordinated as fields for an exquisitely carved relief, which suggested a Maya inspiration.

At Mitla, in Oaxaca, we have the three great "Palace" groups, each composed of oblong buildings on the three sides of a sunken court. The walls were ornamented



CROSS SECTION OF A TEMPLE AT MITLA, OAXACA

(See p. 129 upper)

Compare this Mexican roof with the corbel vaults of the Maya (p. 124 lower). This structural method makes it possible to have wider rooms than under the Maya system. After Holmes 1897

with a mosaic of cut stones composing a lovely fretwork design. The flat roofs were partly supported by massive stone columns, and include the largest completely walled floor spaces found in Central America.

This resumé has covered briefly the principal aspects of Central American architecture. Maya architecture emerged as triumphant glorification of design, as opposed to the Mexican emphasis on

massive planes. Certain specialized buildings were mentioned which although belonging to neither of these major styles, were none the less noteworthy. At the same time it must not be forgotten that Central America is spattered with mounds, the details of which are either irremediably destroyed or else have to be studied by excavation, so that only the broadest outlines of Central American architecture are visible to us.

Note.—The editors are presenting this survey of Central American art in serial form in order to familiarize their readers with the rich substance of these little-known civilizations. Scattered articles, such as have appeared in previous numbers, although suggesting many aspects of Central American art, cannot give so unified a view of the subject as it is hoped will be produced by this series. The editors also feel that the artistic approach, rather than the historical, will render less involved this fascinating, if somewhat complex, subject.



TULOOM, QUINTANA ROO, A FUSION OF MEXICAN AND MAYA ARCHITECTURE. AFTER LATHROP, 1924



The Costa Humming Bird

HUMMING-BIRD HAVEN

Two Bird Photographers Invade the Seclusion of a Colony of Breeding Hummers

By LEWIS WAYNE WALKER AND A. SPOTTSWOOD YOUNG

PHOTOGRAPHS BY THE AUTHORS

LONG had we searched for an ideal hummer's nest, one undisturbed by other humans, but still close enough to home to permit daily visits. We had found some during the last two years, but the carrying on of successful observation seemed hopeless. Close to the center timbers of a porch, saddled on an electric light wire, swung one of the pretty cradles. Lack of sufficient light for photography, however, forced an abandonment of our plans. Another was at the bottom of a steep cañon in an armored yucca, fifty-five miles from San Diego. Daily trips were an impossibility.

We took our troubles to Mr. Frank Gander, of the San Diego Natural History Museum, and on his extensive collecting trips he promised he would watch—and report. A week later came a letter with copious directions for finding two nests near the State College. To the valley described we hurried. Here, where

Lower Murray Dam backs up the waters of a small stream, we came upon a truly marvelous location for the study of birds of many types. And hummers! Black-Chinned, Costa, and Anna! From all the high branches of the sycamores the squeaky melodies of courting males pealed forth.

In vain we searched for the two nests described, but in our rambles we found another, less than two feet from the ground, cleverly saddled on a dead branch of sage. Our hopes soared. Here was the ideal cradle, within range of everything needed,—sun, camera, and home,—impossible but true! Sheltered in the small nest that could easily have been covered with a half dollar, were two white eggs, no larger than medium-sized peas. While we were admiring the dainty construction of the nest and its exquisite camouflage, the old bird tried to drive us away. Darting at us with shrill shrieks of anger, and whirring wings, she came to

within several inches of our faces before zooming into the air.

Finding that we were not to be frightened off, the mother became trustful, and alighted on the nest rim a scant foot from the camera lense. Here she paused for the fraction of a second, then her long beak reached down to fondle her eggs, and she lifted her breast feathers and commenced incubation. Every few minutes she re-arranged the exterior of her lovely little home, when some spider-web ornament or bit of lichen did not suit her. Although our hopes had gone skyward, and we thought success was ours, the next visit disclosed just another wilderness tragedy, made doubly disappointing to us because the little bird even had allowed us to stroke her feathers before our work terminated on the previous afternoon.

Two tiny white eggs lay on the ground—cracked, and the dainty nest was partly torn apart. The remarkably tame mother bird that had posed so obligingly was not now in evidence. On the muddy stream bank a score of feet away were the tracks of a marauding house cat, that told a discouraging story.

Homeward bound, dejected to say the least, we were suddenly startled to see a gorgeous male phainopepla in his black, satiny coat, fleeing with raised crest before the onslaught of an enraged hummer. The smaller bird's colors were somber, meaning the weaker sex, and we ducked in haste to see if she would disclose her home site. This she did. Straight as an arrow she returned to the leafy branch from which she had chased the phainopepla, and on the end of a dead twig settled upon a knotlike-looking ball.



STANDING GUARD

The mother bird gives devoted attention to her nest, which is small enough to be covered with a half dollar



ON THE RIM OF THE SILKEN CRADLE

Humming birds' nests were found in close proximity to one another on the small island protected by water from large red ants—a menace to the helpless young

Investigation disclosed another nest, with its full complement of two eggs.

This was luck,—two nests within a hundred and fifty feet of each other, but, as we found out later, such close proximity was not unusual in Humming-bird Haven. This latter nest had evidently been made in a hurry, and the two eggs deposited while it was still under construction. Spasmodically the old bird would dart off and fly about the bushes. From afar we saw her hover on the side of a sage. Quick as a flash she darted in and swallowed something, then, in mid-air, went back and forth as though hung like a pendulum on an invisible string. This was her method of gathering spider-webs, each strand separately, and her first dart marked the demise of the web owner. Back to her home she flew with this nest material, and with the utmost care wove it around the outside of her dwelling to hold in place loose flakes of lichen.

At one stage in the nest-building the camera caught her eye, and its liquid-like lense intrigued her. Many times she flew to it, to lick its shining surface for possible nourishment. That it was hard and tasteless did not discourage her. She evidently hoped it would melt, and be sweet!

This insatiable interest in the lense gave us an idea. Why, not tempt her with a wax flower filled with sugared water, as a lure for securing hovering pictures? Home again and up until late, cutting out patterns of morning glories, nasturtiums, etc., and tinting them with colored wax. The first hour they failed to arouse much attention, but at last a bird chanced upon them. With whirring wings and motionless body he hovered above, squealing excitedly. Gradually he dropped lower, and then dipped his bill deep into the sweet syrup. His ecstasies rose to heights unknown, as he drank his fill of the man-made nectar,—and our mixture



A COSTA HOME AGAIN

During the breeding season the humming birds darted back and forth continually—seemingly little perturbed by the intrusion of photographers

must have been potent, for he immediately started the unforgettable humming-bird courtship.

On a slender out-jutting branch perched a coy female, and to her his attentions were directed. Flying far into the air, uttering a high-pitched melody (some notes of which sounded like the squeak of an unoiled hinge), he poised, body motionless, then down he dashed, bullet-straight for his prospective bride. When just about to hurtle into her, his wings spread rigidly, and the stiff primaries vibrated as the air rushed through them, giving off a zooming noise. Up in another great arc the midget rose, to repeat the performance time after time.

How long this superb display of prowess would have continued is an unanswerable question, for another male happened by. Darting, buzzing, jabbing, and uttering his battle cry of "Kiki! Kiki! Kiki," remarkably fierce for such a tiny mite of

life, the suitor was after the intruder. For a hundred feet the newcomer fled before the onslaught, then turned to fight. Together they rose high in the sky, beak to beak, and were lost to sight in the azure blue. The female on the branch seemed indifferent to the duel she had caused between the rivals, and before the victor returned she disappeared over the brow of a hill.

While we were watching and also marveling at the aerial gyrations of our wax-flower visitors, we saw three of them go to as many new nests, all within sight of one another. Two of them, however, were high in a sycamore, no good for our needs, but the other was less than nine feet from the ground, and contained just-hatched young. By gentle manipulations we lowered the branch in slow stages until it was ideal as far as we were concerned. The young with bits of shell still beside them were comparable in size

to honey bees. A fine, black fuzz grew out of their feather tracts, leaving only small areas of pink skin showing through. Their beaks were short and stubby, not at all resembling the pointed weapons (or tools) they were to have when adult. As they grew in size, these beaks lengthened. For the first week of their lives they spent most of their time under the feathers of their mother, being left uncovered only for short periods, when she was out foraging for tiny spiders, their food.

After they had passed the first week safely, their diet was changed to nectar, for now the mother's trips were to the flower-covered fields near by. In feeding her offspring, she used the regurgitation method. Although the babies seemed to enjoy it, to us it looked like assault and battery. They would open their mouths

at her approach, and her long bill would disappear into a tiny throat, up to the hilt so to speak. Then started the regurgitation, which was a series of nerve-jarring body racks for young bird and old. At times the mother's actions were so violent that the youngster was almost lifted out of the nest, but let go—never! Not while food was being pumped into his crop. We often wondered why and how the sharp beak failed to pierce the delicate neck walls.

During our daily observations of these young, five more nests came to our attention. One of them, high on a sycamore branch, held fledglings about ready to fly. Every few minutes, sitting on the nest rim, they would try their wings. We watched from below, covetously wishing they were within reach, and on one of our side glances luck played into our hands



SADDLED CLEVERLY ON A BRANCH

A carefully constructed home to shelter the dainty white eggs which are about as large as medium-sized peas

again. The adult bird, coming suddenly to the nest, unbalanced one of the youngsters, and with whirring wings to break his fall, he slowly descended to the ground.

The old bird did not seem to realize her loss, and after about an hour, during which time she made ten or twelve trips to feed the other young one, we decided on drastic action,—namely to shake out her remaining baby. For several feet he fell end over end, then using his wings which were better developed than those of his nest-mate, he started across the brush-tops, traveling more than fifty yards before exhaustion forced a landing.

Placing him in a hat, where he clung for dear life, we reunited him with his brother. Then both of them were perched contentedly on a branch directly below the nest. When the adult bird

came back with family supplies, she was the picture of despair at finding them gone. Her long bill probed through her dwelling several times. Her actions plainly voiced her thoughts,—

“It can’t be true! They must be hiding under this soft covering!”

Convinced that the beak-probing was of no avail, she began a systematic search. Every twig for yards around was most thoroughly scrutinized. During this hunt she uttered soft, anxious, appealing notes, and on nearing her youngsters, received an answer. Once more her manner bespoke her feelings,—

“Life is again worth living! There are my wayward youngsters on a branch, and both together!”

Instantly she was at their side.

Before leaving for the night, we placed both the babies high in a branch, out of



REGURGITATION

The assault and battery of the bird world. At times the mother's actions were so violent that the youngsters were almost lifted out of the nest



A LESSON IN PATIENCE

The young humming birds were always ready to eat, and kept the mother busy foraging for tiny spiders

harm's way, and early the next morning we returned to see how they had fared during the darkened hours. We hunted in vain for the nestlings, and just when we were about to repent our actions in shaking out the baby bird the day before, we heard squeaks high in the air. Looking up, we saw three hummers. Two of them were content simply to hover on whirring wings, without doubt a little afraid of the height. The other, however, dashed back and forth in an ecstasy of joy.

It was thrilling to watch the marvelous control the mother had over her tiny body. Darting forth in "high gear," she would abruptly stop and shift to "neutral," and thence to "reverse," to back up or down in the ether. Her breath-taking speed was hard to compute or reckon, but at one time in showing her pupils "how to do it," she darted back and forth over an imaginary air-line, which we judged to be about a hundred feet long. It took her

but a second—perhaps less—to traverse this distance. "Clocking" her wing beats was at best but a guess. In taking photographs of hovering humming-birds at $1/1000$ of a second we have often found the wings blurred, especially if snapped in the center of the stroke. If at either end of the stroke, however, the wings can be "stopped" with a shutter speed of $1/400$ of a second, for here they must pause infinitesimally before swinging back.

Two more nests we found, making an even dozen for "Humming-bird Haven." Why this colonizing in such a restricted area was a question often voiced but not answered until almost our final visit. One of the last two nests gave us a clue. It was on the far side of a small brook, and when the parent bird inadvertently showed it to us, large red ants were climbing over the helpless young. We did what we could, but the insects were running up the tree by the hundred, and their march

was steady—menacing. There was no stopping the advancing horde. Even the mother, trying to protect her youngsters, had trouble. She would often fly through the air, frantically pecking at a wing, tail, or foot, trying to dislodge a tenacious insect. Before we could get gasoline from the car to make the ants' trail less tempting, the worst had happened. Both fledglings were dead.

Across the brook, where the eleven nests had been found, very few of these large ants were to be seen. Suddenly it dawned upon us! Humming-bird Haven was in reality a triangular island, bordered on one end by Lower Murray Dam, on one side by a reedy marsh, and on the other by a babbling brook. Ants were partly excluded by this formation, and the calamity that befell this one nest (outside the Haven) proved to us the wisdom of the other hummers' choice of location. However, even within their sanctuary, they were not content to relax their vigilance, for three-quarters of their number placed their nests on the

extreme ends of dead twigs, some of them going so far as to use fallen branches that had become lodged on a living bough. They seemed to realize that ants hunting for tasty sap would not be apt to go foraging on a leafless limb.

On the last of our daily visits the humming-bird population of the Haven had swelled considerably. Almost all of the fledglings had forsaken their nests for the freedom of the air, and were big enough—in their little way—to roost on twigs over night. No longer were we able to approach them freely. Neither could we lure the old ones within range,—with the eggs hatched, and the young we had used as decoys, on the wing. Naturally—though regretfully—we were forced to call a halt to our daily trips, but we still drop back occasionally. Humming-bird Haven at the end of the breeding season lost its allurements for the birds in whose honor it was named, and with these feathered jewels of the air missing (until another spring), its chief allurements for us is gone also.



Visiting a Wax Flower



Photograph by U. S. Forest Service

Mimbres Camp, Gila National Forest, New Mexico

AN ARMY IN THE FORESTS

With the Civilian Conservation Corps in the Field

By GUY D. McKINNEY

Assistant to Robert Fechner, Director of Emergency Conservation Work, Washington, D. C.

THREE hundred thousand men, most of them young and all of them imbued with a desire to give Uncle Sam something tangible in return for good wholesome food, warm clothes, and comfortable winter quarters, are writing a new and revolutionary chapter in the stirring but not always happy history of America's once vast and still large forest domain.

With vigorous strokes of the axe, with pick and shovel and the other varied tools of the experienced forester, this youthful forest army, popularly known as the Civilian Conservation Corps, is making a valiant effort to launch the nation on a real forest conservation policy which will stem the destructive tide that for generations has been bearing the nation steadily toward eventual timber famine.

If these young forest workers are successful, and a good beginning has been made, 1933 will go down in history as a red-letter year for foresters, conservationists, and lovers of the great outdoors.

It will be known as the year when America definitely turned from a policy which had permitted its tremendous forest domain to dwindle away, to one whose major purpose will be to protect, rehabilitate, and expand its timber-covered areas.

Every American knows of the Civilian Conservation Corps. Launched last April by the President as a means of bringing workless men and work-hungry forests together for their mutual benefit, the Corps became an instant success. The reforestation and relief bill authorizing the C. C. C. passed Congress late in March and was signed on March 31. Seventeen days later the first camp had been established with 200 hitherto jobless young men as its occupants. By July 1, this first camp at Luray, Virginia, was just one of 1330 forest camps that had been built in all sections of the country. By July 15 the number of forest and National Park camps occupied by men of the conservation corps had increased to 1466. On that date the

enrolled strength of the Corps had been built up to 300,000 men. The big majority of these men came from families whose names were on state or local relief rolls. In the eleven weeks that had elapsed since the reforestation movement was initiated, these men had been selected by the Labor Department, enrolled, equipped, transported, and fed by the War Department, and put to work by technical experts from the Forest Service of the Department of Agriculture and the Department of Interior.

Since that time the camps have been operating at capacity except for a short period in October and early November when several were moved to warmer climates and the personnel of the Corps revamped. The tents in which the men lived during the summer have now been replaced, except in a few instances, with sturdy, warmly constructed wooden bar-

racks. Woolen winter clothing has replaced the summer work outfits. An educational program has been adopted which will give every man a chance to improve his education and to enhance his prospects for obtaining permanent employment when discharged. Otherwise the camps are operating just the same as during the summer. The War Department has full charge of the men except while they are working in the forests. It feeds, clothes, pays them, and looks after their welfare in other respects. The bulk of the men receive \$30 a month, all but approximately \$5 of which is sent directly by the War Department to their families. The leaders in the camps, who constitute 5 per cent of the enrollment, receive \$45 a month; the assistant leaders, who make up 8 per cent, \$36.

It is common knowledge that, as a relief measure, the reforestation plan has aided



Photograph by U. S. Forest Service

THINNING A STAND OF SCOTCH PINE IN PENNSYLVANIA

A large percentage of the boys enrolled in the Civilian Conservation Camps were wholly untrained in physical work and lacking in previous knowledge of the manual labor involved, yet in a few short months they demonstrated a capacity for doing first rate forestry work



Photograph by U.S. Forest Service

AFTER THINNING

This is the same stand of Scotch pine as that shown in the photograph on page 142. A tremendous amount of similar conservation work is now going forward in every part of the nation's vast timbered domain.

300,000 families consisting of more than 1,500,000 persons, and that it has given employment to more than 340,000 persons. Every man who reads the public print knows what the Corps has done in the way of building up the bodies of the young men in the camps. On the average, the men gained seven and a half pounds each during the first six months in camp, and registered a .29 of an inch increase in height. But, while the health and relief phases of the forestry program are well known, not so much is known of the actual work that has been done and is being accomplished.

A study of the work reports reaching the office of Robert Fechner, director of Emergency Conservation Work, discloses that the men have done a great deal more than put on weight, increase their average height fractionally, and develop stronger physiques. The reports

of the foresters and park superintendents, which are filed monthly at Washington, disclose that these youngsters from the cities, small towns, and country districts have accomplished a tremendous amount of worth-while work. If the work they have started is continued in future years, either through the medium of a permanent corps or through more liberal state and federal forestry budgets, millions of acres of forested lands, now headed toward inevitable destruction by fire, disease, insect attacks, or wasteful cutting, will be preserved for the enjoyment of future generations. Trees will be planted on lands threatened by soil erosion. Fire losses, which now aggregate a minimum of \$62,000,000 annually, will be substantially reduced through the establishment of fire-fighting facilities and the removal of fire hazards. Existing forests will be more carefully protected, cultivated, and

expanded. National and state parks and monuments will be refurbished and made accessible to the public.

The work programs now being carried out by the Civilian Conservation Corps boys can be divided roughly into four major classifications as follows:

(1) **FOREST PROTECTION WORK** which will include the construction of trails through the forests, over which fire-fighting units can operate speedily in event of fire; the building of fire breaks to prevent fires from spreading; the construction of lookout towers, observatories, fire guard cabins, tool houses for the storage of fire-fighting equipment; the waging of campaigns on a wide front against destructive insects and tree diseases; the laying of telephone lines; and the construction of emergency fire-control landing fields. The removal of fire hazards such as standing dead trees, old logs and brush along roads and trails, should be included in this general protective classification.

(2) **FOREST IMPROVEMENT WORK** to include improvement of timber stands by thinning out undesirable trees; planting of trees; forest timber and range surveys; and the rounding out

of the National Forest through the purchase and improvement of non-federal timber lands.

(3) **THE CONTROL OF SOIL EROSION** through tree planting, revegetation work, and the construction of simple dams. A certain amount of flood control work also is done.

(4) **THE CLEANING UP AND BEAUTIFICATION OF THE NATION'S PARKS AND MONUMENTS.** During the first six months of the work, much time was devoted to the control of blister rust and other forest diseases which threaten to ruin the most valuable white pine stands in the country. Considerable effort was directed also toward controlling the attacks of insects, and the eradication of rodents and poisonous plants. In many sections of the country the work already has progressed to a point where experienced foresters have predicted that ten years of normal accomplishments on the part of the federal forestry services will have been telescoped into less than a year.

For those who desire a quantitative expression of results in work accomplished, there are included a few figures from a report compiled by the Census Bureau from the individual work reports sent to



Photograph by Crandall

CLEANING UP LAKE SHORES

Civilian Conservation Corps workers removing debris that has accumulated along the shores of Jackson Lake in Grand Teton National Park



Photograph by U. S. Forest Service

IN THE CARSON NATIONAL FOREST, NEW MEXICO

Stands of valuable timber are being put into such condition that the desirable trees will make faster growth and the stand as a whole will produce material of better quality

Washington by the superintendents and foresters supervising the forest work. In presenting these figures, attention should be called to the fact that they represent accomplishments only to September 30, 1933.

The report, compiled from official work records prepared at the 1,522 camps where the men of the Civilian Conservation Corps and the 8,000 Indians of the Indian conservation camps labored during the summer and fall, discloses that the work done will benefit large sections of the 600 millions of acres of forest and park lands in this country. The benefits of forest improvement, forest protection, soil erosion, and park improvement are not confined to the immediate areas where the men worked, but are spread over millions of acres of adjoining lands. The work was done under the supervision of the forestry experts of the Department of the Interior, the Department of Agriculture, and the forty-seven states where

the men were located. Twenty-eight camps containing 5,600 veterans did flood control work under the supervision of the Chief of Engineers of the War Department. Of the 1,522 camps in the continental United States, 1,250 were under the supervision of the Forest Service, 175 under the Office of National Parks, Buildings, and Reservations, seventy-one under the Bureau of Indian Affairs, twenty-eight under the Chief of Engineers, three under the Bureau of Biological Survey of the Department of Agriculture, and one under the General Land Office.

"Improvements done by the C. C. C. men and the Indians will prove of permanent benefit to the forests and of untold value to future generations," Director Fechner said. "The Forest resources of the nation have been given new and valuable protection from fire, pests, and disease, which in the past have taken an annual toll estimated in the hundreds of millions of dollars. Stands of timber have



Photograph by Courtesy National Park Service

YOSEMITE NATIONAL PARK

Typical old logged areas where Emergency Conservation Workers will do valuable work for Yosemite in removing unsightly fire hazards

been improved, erosion of land checked, ranges for the great live stock industry improved, and recreational facilities for the public multiplied. The value of our national and state forests and our National Parks has been greatly enhanced."

Among achievements which stand out in the completed program is the forest protection work. This includes the construction of trails through the forests and parks over which fire-fighting units can operate speedily in event of fire, the construction of fire breaks useful in preventing the spread of fires that develop, the removal of fire hazards such as highly inflammable dead trees and underbrush, the construction of lookout towers, observatories, fire-guard cabins, shelter for fire-protection equipment, the laying of field telephone wires to connect lookout houses with points of mobilization for fire-fighting units, control operations against tree diseases, and campaigns against tree-

attacking insects and rodents. The white pine blister rust, one of the most serious menaces to the nation's 20,000,000 acres of valuable white pine, represented one of the major objectives of the forest army.

Work performed under the general title of forest stand improvement included thinning forest areas to improve the stand of valuable trees, tree planting, and construction of needed buildings and bridges. The general aim of this forest stand improvement was to put the stand of timber into such condition that the desirable trees will make faster growth and the stand as a whole will produce material of better quality.

Erosion control, the third major classification of work projects, developed into one of the most important phases of the Civilian Conservation Corps program.

In addition, the men constructed 2,569 miles of horse and foot trails through the forests, built 1,053 dams for fish and birds; erected 882 miles of fences, including

both those surrounding camp sites and range fences of barbed wire and log; collected seed; surveyed and marked 7,485 miles of boundary; improved 716 miles of streams; carried out flood control projects to the extent of 19,866,555 feet of ground surveyed, 356,476 cubic yards of ground along banks of streams cleared, 54,951 linear yards of channel cleared, and 36,532 cubic yards of dams excavated and filled; reconstructed existing dams by such measures as levee reconstruction, log-ribbing and landscaping; cleared 9,175 acres of public camp grounds; built necessary buildings; made 6,288 of such camp ground facilities as benches, tables, fire-places, etc.; aided in the construction of camp structures, which include 843 tool houses, 406 offices, 112 barns and 2,795 other structures, as well as 38,847 feet of water systems.

From the beginning, the Forest Service of the Department of Agriculture and the

National Park Service of the Interior Department welcomed the C. C. C. movement as a real opportunity for accomplishing needful work in the forests. It was also recognized that the sending of so many city men into the forests could not help but bring the general public closer to forestry itself.

In a recent discussion of the activities of the C. C. C. men, F. A. Silcox, forester of the Forest Service of the Department of Agriculture, commented favorably on the work being done at the camps to increase forest protection, improve forest stands, and correct soil erosion. He pointed out that something like fifty-five different classes of work are now being done in the camps.

"I would like to comment on the pest control work and steps taken to combat tree and plant diseases," said Mr. Silcox. "There has never been presented before to the Forest Service such an opportunity



Photograph by U. S. Forest Service

CLEARING A TRAIL THROUGH THE FOREST

Boys from Pine Grove Furnace Camp, Pennsylvania, constructing trails through the forest, over which fire fighting units can operate speedily in case of fire



Photograph by U. S. Forest Service

ROAD CONSTRUCTION

The construction of roads, their improvement and maintenance are among the important phases of the Emergency Conservation Work now being carried on by the Government

to conduct work of these kinds on a scale such as has been afforded by the Civilian Conservation Corps, and all of this under the supervision and direction of men best trained and qualified for such supervision. These men in turn in certain sections have been advised by the nation's best authorities on plant disease and insect pest control. These enemies rank with or even outrank forest fires as a menace to the nation's forest properties."

As a move toward halting the huge annual losses attributed to soil erosion, some 50,000,000 trees are to be planted in central and southern states this coming spring. Exceptional efforts also are to be made during the coming year to save forests menaced by European white pine blister rust disease and other tree-attacking diseases. Campaigns also will be organized to combat the attacks of insects which annually cause huge damages to forest trees and to scenic trees on estates and in parks.

During the past summer and fall, more than 20,000 Civilian Conservation Corps men were engaged in national defence against foreign plant diseases, especially the white pine blister rust. This latter disease is spread by wild and cultivated gooseberry and currant bushes. In order to protect the pine stands from this fungus disease, all wild currant and gooseberry bushes must be pulled in a protective zone 900 feet wide around the pine trees as well as within the pine lot. All cultivated black currant must be removed within a radius of one mile. This is a tremendous undertaking and one on which the Department of Agriculture and the various coöperating states had not made as much headway as they would have liked, until the coming of the C. C. C. boys.

The usual method of attack is to destroy the *Ribes*. During the past summer, fall, and early winter, the C. C. C. men pulled 48,962,419 currant and gooseberry bushes

from 598,054 acres. The greatest volume of C. C. C. blister rust control was performed in California, Idaho, Wisconsin, Minnesota, Pennsylvania, New Hampshire, and Maine. New infections of blister rust have recently been discovered in National Parks and on state forest lands. As a result of the C. C. C. work, scenic spots have been saved from unsightly diseased trees and the lumber industry saved tremendous losses from disease. In 1934 all valuable pine areas unprotected within a working radius of the C. C. C. camps probably will be the scenes of control work.

A few concrete examples may illustrate better than cold statistics some of the varied types of work which the men of the conservation corps have carried on and on which they are now engaged. For instance, the men living in some 200 camps located in state parks are installing improvements such as new camping grounds,

more commodious parking areas, permanent park structures such as shelters, spring houses, bridges, bath houses, and bathing beaches. This work is being done largely in the interests of tourists and campers.

Along the old Miami Canal from Toledo to Defiance, Ohio, five companies of the C. C. C. are developing the land adjacent to the canal into a practical park that will be one of the most attractive in the state. For a distance of nearly fifty miles the men are building trails, landscaping the area, making use of portions of the canal for water sports and recreation, and in general turning the area that has heretofore been practically useless into a useful park. The same type of work is being done by a dozen companies of the C. C. C. in the famous Palisades Interstate Park in New York. The work of the C. C. C. in the State Parks, as well as in the National Parks



BUILDING A LARGE DAM

This type of dam not only requires a maximum amount of man power, but also requires the use of tile, cement, and other materials for proper construction

and monuments, is under the direction of the office of National Parks, Buildings, and Reservations of the Department of Interior. In the National Parks, camps of the C. C. C. are adding long-needed recreational facilities for the use of the public. The fact that the number of visitors to Sequoia National Park in California alone increased from 30,000 in 1923 to 129,000 in 1933 shows that more than ever the American public is taking advantage of its parks for recreation.

Another interesting type of work being done by the C. C. C. is the rehabilitation of several of our famous national battlefields. About 3,500 men are working toward this end in Yorktown, Virginia; Morristown, New Jersey; Gettysburg in Pennsylvania; Chickamauga, Tennessee; Vicksburg, Mississippi; Petersburg, Fredericksburg, and Richmond in Virginia. It is not the plan completely to restore these historical spots, but to restore them to such condition that the average visitor will come away with a clear understanding not only of the important events that

took place but also their relation to the growth and development of our nation.

Further recognition of the importance of the nation's wild life resources was manifest when on May 29, 1933, the President approved the establishing of three C. C. C. camps on as many migratory bird refuges, acquired by the Bureau of Biological Survey under the provisions of the Federal Norbeck-Anderson Migratory Bird Conservation Act of 1929. These refuges, under the administration of the Survey, are located on an eastern flight line of wild fowl. One is on the Blackwater River in Maryland; another in North Carolina, and the third on the St. Marks River in Florida. The camps were established about the first of July, and since that time an immense amount of development work has been accomplished to make the refuges more attractive to migratory bird life and facilitate their administration and maintenance. The intense interest of the men in these camps was remarkable, and they evidenced a real desire to learn more about bird life.



LAWTON CAMP, GILA NATIONAL FOREST, NEW MEXICO

*Sketch by
Dudley Blakely*



"VIRGINIA"

TRAILSIDE FAWNS

An Adventure in Animal Upbringing

By WILLIAM H. CARR

Assistant Curator, Department of Education, American Museum

A bright July sun streamed through gently stirring leaves of our largest sugar maple and cast wavering yellow patches upon the brown earth of the deer enclosure. Virginia and Bambi, our white-tailed deer fawns, were sleeping peacefully with delicate, black-tipped noses resting upon soft, tan flanks. The sun pattern matched their white-spotted coats so well that one was instantly struck with the "protective" value of the design.

It was a peaceful early summer morning on Bear Mountain. There were two automobiles in our Trailside Parking space, with license plates reading "California" and "Oklahoma." The occupants of these cars strolled quietly about the grounds, reading labels and commenting on exhibits indoors and out.

A golden-haired little girl was the most active of the party. She fairly burned with energy, as she ran here and there,

peering into the snake-pit, calling to Joe, the crow, and all but falling into the fish pool. After a time she found the deer and stood transfixed with interest and admiration. Her father and mother joined her, and together they read the label and remarked what beautiful creatures were the deer.

"I'd love to pet them," exclaimed the child, "do you suppose they'd let me?"

"No, I should say not," said the father, "things in museums and zoos are made for people to look at, not to touch."

"I don't see why that is, either," said the mother. "Scientists seem to have all the fun. We can only look at what they think we ought to see!"

Bambi twitched one ear to drive off several over-enthusiastic flies which were becoming increasingly annoying. Mr. Roos, our animal enthusiast, strolled over to the deer-pen and opened the gate. He looked at the little girl invitingly, and said:

"Don't you want to come in with me and play with the fawns?"

The girl cast a beseeching look at her mother, who in turn, looked questioningly at father. After a moment, with the full responsibility resting upon him, father asked:

"Is it safe"?

"Perfectly safe," said Mr. Roos, "many hundreds of children have played with the deer. We have even permitted blind persons to come in and see the animals in their own way."

"I read something once about George Washington's gamekeeper being killed by supposedly tame deer," replied the man, "but if you say so. . . ."

This was permission enough for the child. She flew through the gate and knelt beside the now awakened Virginia.

Bambi rose to his knees, then to all fours, stretched blissfully, and wandered over to investigate the latest caller. He sniffed daintily at her face and then ran an experimental soft tongue over the little girl's arm. Apparently satisfied with the taste, he commenced to lick, with an absent-minded air, suggesting a "better than nothing" attitude.

"Ar-ren't they cute," shrilled the child, "I'd like to have them home! How thin their legs are!"

The fawns, with their usual meek acceptance of adulation, were quite patient as their sleek coats were stroked and patted.

The child's mother looked on—first with an expression of some anxiety, and then with a decidedly pleased smile, as she turned to her husband, saying: "Well,



Photograph by Clyde Fisher

BAMBI AND VIRGINIA

The fawns were never awkward in any pose, whether lying, standing, or in motion. Here they are resting after a meal

museums have changed since my day! John, get the camera."

After our visitors' first excitement had given place to careful examination, they began to ask questions. The very calmness of the fawns seemed always eventually to quiet their audience. By this time, the Oklahoma people had arrived, and their children, a boy and a girl, were permitted to enter the pen.

"Where did you get the deer?" asked the father. "Are they from India? We saw some like them yesterday in the Indian Hall at the American Museum of Natural History."

"It was the Hall of Asiatic Mammals," corrected daughter.

Mr. Roos had observed that the man had read the label, or rather looked at it. Although the sign told at length about the deer, Mr. Roos's experience with visitors had taught him to realize that "glancing" and "absorbing" were two different things.

"Everything we have here is local," he answered. "All of our animals, and all of the specimens in our museums have been taken from the Highlands of the Hudson."

Mr. Roos continued to tell of the deer's habits, until fully satisfied, but with backward glances at the three-months'-old fawns, the guests walked away.

"Delightful creatures," one woman said.

Virginia had been the first of the deer to



Photograph by Clyde Fisher

ALERT

Bambi's expressive ears were keyed to every sound. He was ever interested in events that transpired beyond the confines of his enclosure

come to us. When not more than a day old, she had been pursued by dogs and, as the story was related, had the great good fortune to run literally into the arms of a protector in the form of a kindly disposed lady upon the estate of the president of the Rockland County Association for the Prevention of Cruelty to Animals. Surely, she was in good hands! In fact, the woman who cared for her came to see Virginia often after she had been given to us.

Virginia had taken to the nursing bottle almost at once and was a most persistent feeder from the first. Her agitation was

great whenever the bottle appeared. She would apply her lips to the rubber and, with surprising energy for so frail an animal, would "punch" repeatedly, until the last drop had disappeared.

This fawn showed much interest in whatever transpired near by. She would follow us willingly and would come trustingly along wherever we went. For a time, she was kept in a chicken-wire enclosure upon a grassy slope. We covered the wire with cloth to prevent the delicate "pipe stem" feet from becoming injured through insertion in the wire mesh. The cloth was also necessary to prevent the infant from bruising herself when playing, for play she did! She would leap about, with no evident sense of direction whatsoever, reminding one of the stiff-legged progeny of the goat. Her little legs would fly out, as she

jumped first to the right, and then to the left. Often she would dash straight at the fence and then, when it seemed as though she would certainly break her neck, the sharp little pointed hoofs would be brought to bear and she would stop inches away. Sometimes, however, she would misjudge the distance, and strike the mesh with some force. We called it "putting on the brakes."

When hungry, Virginia would call with a penetrating "bleat" that could be heard for some distance. She would repeat this monotonously, until her stomach had been filled. At first, Mr. Roos, who had a sincere affection for the infant, found it necessary to feed her at least six times a day. He diluted the milk with water, heated it, tested the drops upon the back of his wrist and, if all was well, performed his duty in admirable fashion.



MAKING FRIENDS

Many hundreds of delighted children and grown-ups as well were only too pleased to make the fawns' acquaintance. A fresh maple leaf was acceptable as an admission card



Photograph by Le Roy Davies

TWO BABIES

Little Cynthia Roos lost the nursing bottle to the impetuous Virginia. The fawn was not to be denied, but Cynthia took it all in good part

Several weeks after Virginia had accepted our hospitality, we were the recipients of another fawn—this time from Mr. John J. Tamsen, superintendent of the Palisades Interstate Park. Some men employed on the new highway over Bear Mountain had picked him up when going to work in the morning. The small creature lay upon the floor of Mr. Tamsen's car, a quivering bundle of nerves, with large, staring brown eyes.

The frightened creature was gathered in Mr. Roos's arms, quite unprotestingly, even as "the lamb that strayed from the fold," and tenderly deposited upon a blanket in the Crafts-house. Virginia was carried in from the outdoor cage to make the stranger feel at home. She proved a splendid hostess, for at once she

greeted the guest with nose rubbing and with much licking, and then, the preliminaries over, lay down beside the newly christened Bambi, with her head upon his shoulder.

Several hours later, it was deemed time to experiment with the first feeding, and here the real difficulties arose. Bambi would have absolutely nothing to do with the bottle! He seemed paralyzed with fear and bleated so loudly in his attempts to escape that his keepers were in despair of ever raising him. This bleat was entirely different in character from the one given by Virginia whenever feeding time was at hand. It had a wild, horn-like quality, that fully expressed the mortal fright of the fawn. It so startled its hearers at close quarters that the

first bottle was dropped upon the floor.

A car was dispatched to a drug store in Highland Falls, five miles away, for some rubber tubing. It was evident that the nipple would not work. Visitors crowded the Crafts-house door with advice.

"Stick his nose in a pan of warm milk—that's what we do with calves!"

"Hold him down, he'll take the nipple."

"Put some milk on your finger and teach him to suck that way!"

These, and other suggestions, were showered upon us gratis, until we closed the door and went off to permit Bambi to rest. Eventually all of the procedures were tried and many others, too, in order to save our infant's life. For forty-eight hours he resisted every effort. We were as gentle as could be. Our men labored into the midnight hours, soaking their clothes

with warm milk in the process, and still the hunger strike persisted.

Virginia, in the meantime, enjoyed the affair hugely. She licked the milk from garments and floor impartially and gambolled about in the Crafts-house, with a callous disregard for the suffering of her companion. It is true that she groomed his coat with her tongue many times during the day, but her solicitations were inspired by motives that were largely selfish—Bambi's coat was saturated with milk!

When two days had gone by, the entire staff was downcast at the prospect of losing the now weak little animal, and then, at eleven o'clock at night, Bambi fed! Virginia really saved his life, for we pressed her into service as a last resort. With unshaken perseverance and kindly patience, the extra large nipple upon the



Photograph by Le Roy Davies

A BOTTLE IN RESERVE

There was never any hesitancy on Virginia's part when feeding-time came. She literally "climbed" to reach the bottle



Photograph by Le Roy Davies

A STUDY IN CONTENTMENT

The fawns had peaceful ways. They never quarreled, even when one attempted to steal the other's food. Mr. Lewis, a friend, looks contented, too

milk bottle was placed crosswise *through* one side of Virginia's lips in such fashion that it projected from the opposite side. It had been noticed that Bambi, on several occasions, had licked drops of milk from Virginia's face. Therefore, it was thought that in licking he might possibly encounter the nipple and thus learn to use it, and he did!

His tongue explored the rubber surface for a time, forcing the milk out, and then the lips slipped over the surface and, marvel of marvels, he commenced to feed! Virginia was forcibly held perfectly still and behaved admirably. There was joy in camp that night!

Days passed before Bambi learned to nurse properly. Many different types of nipples were tried in the process of education, but at last he approached, and then

surpassed, Virginia's eagerness, whenever the clinking bottles were carried to him. Best of all, we could see that he steadily became more robust and active. His expressive, cupped ears moved forward and backward at the least sound, and gradually he commenced to play. When placed in the out-of-door pen, he gained complete confidence and, by mid-summer, outshone Virginia in alertness, strength, and friendliness.

During the season, a companionable coach dog, or Dalmatian puppy, was permitted to enter the deer pen. The fawns were interested in her arrival, despite the fact that one of them, Virginia, had been nearly killed by dogs a short time after her birth. The puppy was held upon a leash and gradually allowed to touch noses with both fawns. The deers'

ears pointed forward—the embodiment of great question marks—and their eyes narrowed perceptibly, but they were in no way alarmed. On the contrary, they commenced to play with the little dog.

On learning that the best of relations existed, we unleashed the dog and, with violently wagging tail, she galloped about the enclosure and the deer galloped too! They licked noses, pursued each other, and were enjoying themselves hugely, when suddenly the puppy, now highly excited, began to bark. This strange procedure startled the fawns. At once they stopped running and gazed inquiringly at the excessively cordial, flapped-eared puppy. Barks were beyond the deers' comprehension and, try as she would, the dog could not resume playful relations as long as she persisted in "yapping."

At another time a very young and comically awkward Airedale puppy was

placed in the pen. He investigated the deer thoroughly, even to the extent of standing upon his hind legs, with forefeet on Bambi's side, in a successful effort to touch noses. Bambi returned the compliment by examining practically every inch of the Airedale's curly, diminutive form. As a visitor remarked, "It was great fun while it lasted!" But after a time, the puppy grew tired, yawned impolitely, and calmly lay down for a nap, whereupon the deer retired to a far corner of the pen and did likewise.

Throughout the entire summer the fawns led a happy, playful existence, with a very notable exception. Near tragedy stalked them but once—tragedy that had to do with taut nerves, tried to the point of hysteria. It was due to a terrific thunderstorm, accompanied by a cloudburst that flooded our Crafts-house floor to a depth of four inches in the space of twenty minutes.



HARD AT WORK!

Mr. Roos found it necessary to grasp the bottles firmly indeed, as the fawns gained in strength. Their "punching" activities grew increasingly strenuous

On this occasion the deer were living in a large, new, out-of-door pen, equipped with a small house for shelter. The house door was closed when the storm came raging through the Highlands. Several of our staff were working near by in the office of the Geology Museum, when blinding sheets of rain poured upon the roof. The men were intent upon some trees beside the road that were tossing their heads dangerously, as the wind's force increased to a steady gale that drove the rain in horizontal sheets.

Not many moments passed before Mr. Bispham, our geologist, suddenly exclaimed:

"What about the deer?"

Without waiting for an answer to his question, or for rubbers either, he threw a raincoat about his shoulders, and plunged out into the storm, fighting his way against the wind, through water that was ankle-deep, to the deer-pen. He was drenched to the skin before the gate was reached. Both deer were in a pitiable condition. They had become completely unnerved and were jumping again and again at the wire, trying desperately to escape the sounds that crashed about their ears.

Quickly Mr. Bispham opened the shelter door and guided Bambi within. Virginia was too terrified to be led. She resisted his efforts and continued to jump, striking the wire and rebounding



TWO POSITIONS

Virginia and Bambi would follow the bottles, in the cage or out, until not one drop remained!

to the slippery earth with startling force. It was evident that she would break her neck if permitted to continue her struggles. After several futile attempts she was caught and carried to the shelter, her sides heaving and her tongue out. It seemed that she would expire from sheer fright. Gradually, however, she became calm, and rested as Bambi looked on.

Like many a violent storm, this one passed rapidly, leaving fallen trees and broken branches in its wake. On close examination, Virginia proved to be practically uninjured and none the worse for the experience. The only signs of injury were several small cuts upon the head,

where she had struck the wire in her senseless attempt to free herself.

She accepted her supper and, the next morning, strolled about as though nothing had ever occurred to disturb her equilibrium! From that time forward our first duty on the approach of a storm was to block open the deer-pen shelter door. Too much affection and care had been lavished upon the fawns to contemplate a re-occurrence of any threatening catastrophe.

After six months of homage as public characters, Virginia and Bambi were transferred to an enclosure of more than an acre in extent. A small, but constant brook ran through the center, and large oaks provided shade. The fawns revelled in their release. They dashed about from one end of the pen to the other, tossing dried grasses and scattering dead leaves as they went. In a brief time they discovered a muddy spot beside the brook. Here they stood for long periods, with

their hoofs buried in the cool, damp earth. Apparently, our other cage had been deficient in provision for foot baths. The deers' actions informed us of our short-sightedness in this respect.

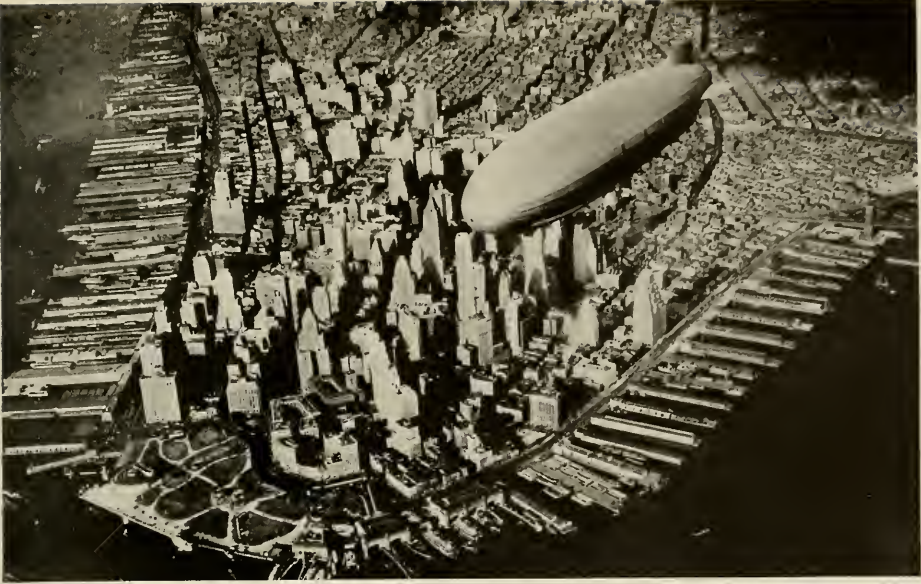
Both animals had been weaned and were able to fend for themselves, feeding upon a mixture of oats and wheat and upon the plants in the enclosure. Their coats took on a grayish tinge as winter approached. A large, hollow haystack, with a wooden frame in the middle, provided shelter from wind and snow.

Our last view of them for the season was a happy one. They stood beside a mirror-like pool in the brook, their reflections brightly outlined, with ever inquisitive noses and ears alert to the October breeze for whatever information it might bring.

When spring comes again Bambi and Virginia will be fawns no longer, but will be grown deer ready for an appreciative public.



Sketch by Dudley Blakely



From Pwning Galloway, N. Y.

Lower Manhattan, New York, 1933; Left, Hudson River Piers; Right, East River Piers

NEW PIERS FOR GIANT SHIPS

The Geologic and Engineering Problems Involved in the Construction of New 1100-Foot Piers in the Port of New York Are Briefly Considered

By CHESTER A. REEDS

Curator of Geology, American Museum of Natural History

To John McKenzie, Commissioner of Docks of the City of New York, Francis T. O'Keefe, Chief Engineer, and Alfred J. Duggan, Resident Engineer, I express my thanks for their kind coöperation, and for the loan of various charts, sketches, and photographs prepared by the Dock Department in the course of the investigation of the physical conditions of the rock in the site for the new piers. I also express my gratitude to the Board of Trustees, to Dr. F. Trubee Davison, President, and to Dr. George H. Sherwood, Director, of the American Museum of Natural History, for allowing me time from my duties as Curator of Geology, to make this investigation. To Mr. Ray N. Spooner, and Mr. F. R. W. Cleverdon, Vice-President of the Allen N. Spooner & Son Construction Company, I express my thanks for courtesies received when visiting the excavations, and for the loan of a set of photographs.—C. A. R.

THE construction of new piers for giant ships in New York is in keeping with the remarkable growth of the City. Situated on a number of islands facing the Upper and Lower bays, and being surrounded by deep estuaries leading inland in various directions, New York has been ideally placed to handle commodities by water. Having been blessed with one of the best natural harbors in the world, New York, with more than ten million people in its metropolitan district, has grown to be the

chief port of the North American continent.

The Hudson, the principal waterway of the harbor, being a drowned river with tides extending to Troy, provides a natural entrance into the interior of the United States. Some 25,000 to 35,000 years ago the coast line of the region at the mouth of the river subsided, and the course of the Hudson, for approximately 151 miles inland and 100 miles across the continental shelf, was submerged. With the drowning of the river only a few



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LOWER MANHATTAN, NEW YORK, 1876

East River with wharves and sailing vessels in foreground; Upper Bay and Hudson River in mid-distance; New Jersey shoreline in the background

natural impediments to navigation remained in the harbor. These consisted of occasional fogs, scattered rocks, and the mud flats across the mouth of the river. Progress has been made in remedying these defects, namely: The harbor has been well lighted and fog horns established. The rocks have been blasted away. The mud flats, which arise by the natural tendency of the river to drop its load of silt where its current meets the ocean waters, have been removed in part. From 1899 to 1914 the Federal Government dredged the Ambrose Channel across the Lower Bay at a cost of \$5,000,000. The Channel extends in a nearly southeasterly direction from the inner harbor to the ocean and has a length of seven miles, a width of 2000 feet, and a depth at mean low tide of 40 feet. This channel permits the largest of ocean vessels to enter the harbor without difficulty. For many years the Old Main Ship-Bayside-Gedney Channel, width 1000 feet, depth 30 feet, sufficed. It is horseshoe-shaped in outline and follows the natural course of the river channel across the Lower Bay. It is five miles longer, however, than the Ambrose Channel. The new Anchorage Channel in the Upper Bay, which is 2000 feet wide and 40 feet deep at mean low water, continues

the course of the Ambrose Channel. The mean range of tide is about 4.5 feet.

When Hendrick Hudson anchored the "Half Moon," the first ship to visit the harbor, off the west shore of Manhattan Island on September 13, 1609, a row boat and a sandy beach served for a landing. The first wharf erected by the early Dutch settlers was built 1648-1649 on the East River at the end of Schreyer's Hook. It seems to have been the first and only pier in New Amsterdam until a larger one known as "The Bridge" was built in 1659, near the foot of the present Moore Street. In 1695 the City, then under English rule, had a great dock which extended along Water Street from Coenties Slip to Whitehall Street. By the amended charter of 1730, the docks, slips and wharves, with all the profits arising from them, were granted to the City. By the time of the Revolution there were six slips on the East River, and two docks and one slip on the North River at the foot of Oswego, now Liberty Street. After the Revolution, New York grew to be one of the leading cities of the United States.

During the Nineteenth Century, the low areas along the shore line were filled in and an extensive line of wharves were developed. On the west side of Manhattan

Island a continuous line of dock buildings was built for a distance of about four miles. On the eastern shore numerous piers were erected. In Brooklyn piers and docks were extended along the greater part of the shore opposite the lower end of Manhattan and farther south in Gowanus Bay. With the completion of the Erie Canal in 1825, New York became the center of commerce for half the continent. With the phenomenal growth of the great trunk-line railroads, 1840-1860, most of which built their terminals at tidewater on the New Jersey shore opposite Manhattan, there developed the car-float literage system of freight transfer. Although there was a radical change about 1860 from canal to railroad transportation, New York retained her position as the chief shipping and industrial center of the United States. In fact, the ocean, the rivers, the canals, the railroads, and a productive hinterland continued to transform the life of the harbor, increase the waterfront developments, add value to property, and make New York great.

In 1860, the combined exports and imports of New York were valued at \$311,358,064, with New York handling twice as much of the country's import trade as all the other American ports combined. The population of the City at that time was 800,000, the five boroughs more than 1,000,000, and the New York region more than 1,800,000. Throughout the remainder of the Nineteenth Century and up to the present, the City has continued to grow in two directions—vertically and horizontally. The population of the five boroughs of New York in 1900 was 2,507,414; in 1930, 6,930,446. The population of the metropolitan area in 1930 was 10,901,424.

With the continued growth of the City and its metropolitan district there has been an increasing demand for New York waterfront property. In 1870, the Department of Docks of the City of New York was created. It is charged with the construction, care, and maintenance of the City's waterfront. More than a half million people are directly occupied in



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HUDSON RIVER DOCKS LOOKING NORTH ON WEST STREET, 1906

The west side of Manhattan Island is lined with piers from the Battery to 72d Street, New York. Groups of docks appear at points beyond



From Ewing Galloway, N.Y.

DOCKS AND WAREHOUSES OF THE BUSH TERMINAL, BROOKLYN, N. Y.

Air view of one of the most active sections of the Port of New York

all-the-year round employment on the waterfront. By 1930 it had made improvements having a value of more than \$250,000,000. The direct waterfront of Greater New York is 587.4 miles in length. A considerable portion of it is as yet undeveloped. The improved waterfront around piers and bulkhead lines in 1924 measured 275 miles. In 1930 the number of piers, both public and private, was 722. Of these, 277 were owned by the City of New York, 409 privately, 27 by the United States Government, and 9 by the State of New York.

Throughout the history of the Port, river and harbor developments have been subject to some sort of official control. The first systematic attempt to authorize and regulate the building of piers along the waterfront was by the New York State Legislature in 1796. In the course of time, however, piers were built in more or less haphazard fashion and with the overlapping jurisdiction of two states, New York and New Jersey, and the

various municipalities, the Federal Government, by an Act of Congress passed in 1888, assumed the authority to fix bulkhead and pierhead lines throughout the Port in the interests of commerce and navigation, and created a Board for that purpose under the War Department. This was one of the first steps taken toward the coördination of port facilities. Since that date the Department of Docks of the City of New York has frequently been given permission to extend the pier head line outward. Since 1921, the affairs of the Port have been under the Port of New York Authority, a body created by special agreement between the states of New York and New Jersey, and the Federal Government. It has under its supervision 1463 square miles of territory, containing 771 miles of waterfront, 341 miles of which are improved. The City has control of all water inside the pier-head line.

In 1930 New York collected more than \$7,000,000 as rental for the piers and

bulkheads it owns. The revenue for 1928 was \$7,725,479.96, while the expenditure for maintenance was \$1,600,000. The highest rental, \$300,000 a year, is received for Pier 86, North River, with Pier 84 next at \$270,000. Both piers are leased to the United American Lines. The vessels that entered the Port in 1930 numbered 4997; their cargo amounted to 43,244,036 long tons, which was valued at \$1,882,187,459. During the same year, the 5366 ships which cleared the port carried a cargo of 15,422,962 long tons valued at \$1,699,794,188. The total imports and exports thus amounted to 58,666,998 tons, valued at \$3,581,981,647. Although these figures are considerably under those for 1920, it may be noted that nearly one-half the foreign commerce of the United States is now handled by the Port of New York, that more than two hundred companies and agencies operate to foreign ports, and at least sixty lines are employed in coastwise and river trade.

While the New York waterfront has not

yet been fully developed, the traffic conditions in the Port have been so congested at times that special regulations have been suggested. The commerce of the Port is not only immense, but more than 350,000 people are carried daily in the ferries which ply back and forth.

Of the 5000 to 6000 vessels which enter the Port in the course of a year, some 200 are great ocean steamships with tonnages ranging from 14,000 to 56,000 tons. The six largest vessels according to Lloyd's Register of Shipping 1932-1933, have the following dimensions:

| | <i>Length¹</i> | <i>Breadth</i> | <i>Depth</i> | <i>Flag</i> |
|------------|---------------------------|----------------|--------------|-------------|
| Majestic | 915'5" | 100'1" | 58'2" | British |
| Leviathan | 907'6" | 100'3" | 58'2" | U. S. |
| Bremen | 898'7" | 101'9" | 48'2" | German |
| Europa | 890'2" | 102'1" | 48'0" | German |
| Berengaria | 883'6" | 98'3" | 57'1" | British |
| Rex | 833'8" | 97'1" | 47'3" | Italian |

These ocean liners are, of course, a very small minority of the ships that use the harbor facilities of New York, but they

¹Note: Length between perpendiculars, that is, from the stem to the fore part of the rudder post.



From Ewing Galloway, N. Y.

THE SOUTH STREET DOCKS ON EAST RIVER, LOWER MANHATTAN, NEW YORK
The wharves and skyline of Brooklyn appear in the background

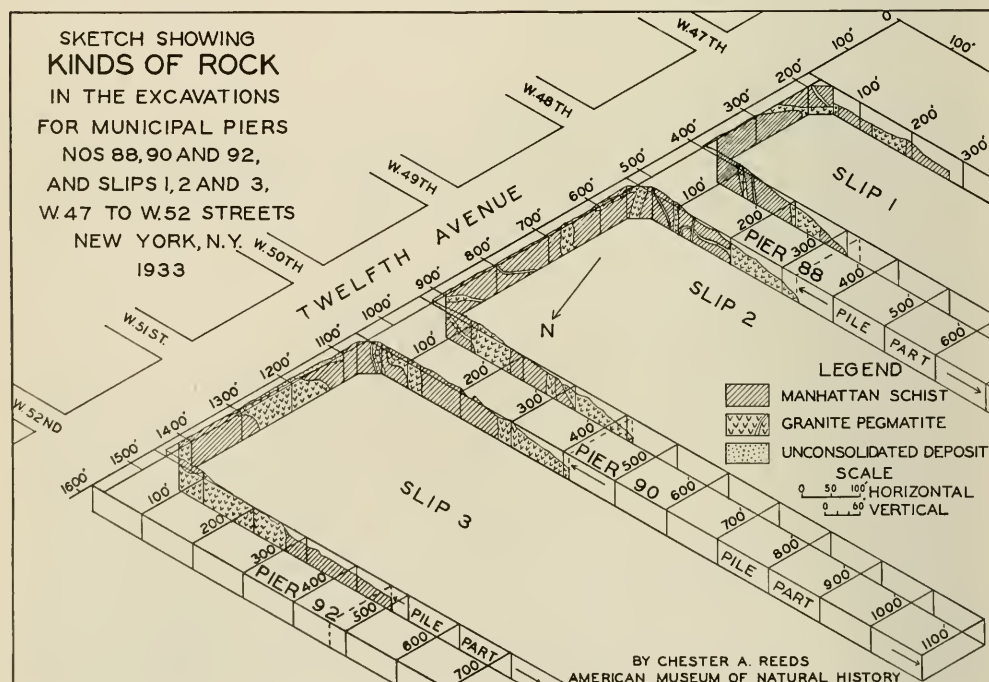
are both dramatic and important, and their enormous size creates, in the mind of the traveling public, an impression greatly disproportionate to their number. Their dimensions, too, are so great that the normal facilities of the Port are inadequate. Consequently, with each new and larger ship that is launched, new and larger piers and docks must be constructed, in order that the floating giants may be docked properly.

For this reason the City was forced to consider the problem presented by the two enormous ships now being built by the Cunard Line and the French Line, each of which is more than a thousand feet in length, for no piers now in use could care adequately for vessels so enormous.

The restrictions imposed by the War Department on bulkhead and pierhead lines made impossible the construction of piers of the required length, without

cutting deeply into the shoreline. Piers have already grown so long and the traffic in the North, or Hudson River, has grown so heavy, that further extensions of the piers into the river would tend to obstruct the port's proper operation. Consequently, with piers 1100 feet in length absolutely essential, the shore line would either have to be moved back sufficiently to build such piers behind the established pierhead line, or, if this was found impracticable, to move the shore line as far back as possible and make up the deficiency by moving the pierhead line out.

The only site in the waters surrounding Manhattan Island that came near fulfilling these specifications extended from the foot of West 47th Street to West 56th Streets, North River. The use of this site, however, required (1) that the pier slips would have to be cut out of solid rock for a distance of at least 305 feet,



SKETCH SHOWING KINDS OF ROCKS IN 1100-FOOT PIERS, 88, 90 AND 92, NEW YORK
The metamorphosed Manhattan schist and the intruded granite pegmatites show a mixed relation.
The unconsolidated deposits consisting of glacial deposits and river silt occur on the surface

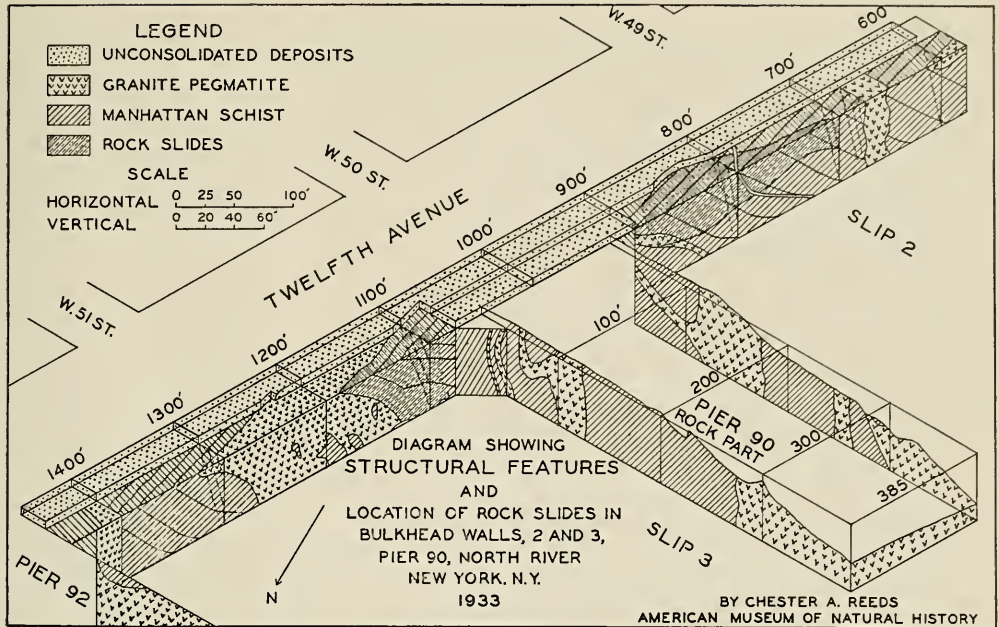


DIAGRAM OF THE ROCK STRUCTURE, PIER 90, NORTH RIVER, NEW YORK

An isometric sketch showing the structural features and relations of the rocks in Pier 90, and adjacent bulkhead walls. Rock slides occurred in the more densely shaded areas

and for some slips more; (2) that a slight extension outward of the existing pier-head line would have to be obtained from the War Department; and (3) that the course of Twelfth Avenue would have to be extended northward for nine blocks from West 47th Street across grounds occupied in part by privately owned buildings.

After due consideration new bulkhead and pierhead lines for the above mentioned site were established by the Secretary of War on January 13, 1931. The territory within the newly approved lines permitted of the erection of five new piers each 1100 feet long and 125 feet wide with accompanying slips each 1100 feet long and 400 feet wide. Plans for the immediate construction of three of the piers and accompanying slips were approved by the Dock Department of the City of New York on July 1, 1931. The contract for the construction of them, however, was not let until November 14, 1931, when the Allen N. Spooner and Son

Construction Company started work on this huge undertaking.

The site faces the Hudson River estuary, which is a drowned river channel filled for the most part with sand, clay, and silt, to a depth near mid-channel, at 32d Street, of approximately 350 feet. Soundings off shore from the pier sites show the depth of the river water to be 60 feet. The concrete wall on the old bulkhead line, established April 25, 1890, by the Secretary of War and which has been for the most part removed, extended in a nearly north-south direction, about 325 feet west of the bulkhead wall of the new slips. A westwardly sloping bed rock slips. The concrete wall on the old bulkhead line, established April 25, 1890, by the Secretary of War and which has been for the most part removed, extended in a nearly north-south direction, about 325 feet west of the bulkhead wall of the new slips. A westwardly sloping bed rock surface served as the foundation for this old bulkhead wall. The footing consisted of bags of concrete laid by divers on the natural rock. The wall itself consisted of huge blocks of precast concrete set upon the concrete bags. When removed from the pier slips, the concrete bags and the blocks showed no signs of deterioration although they had been submerged in



PIER 86, AND SITE OF NEW 1100-FOOT PIERS
Cofferdam, mid center, being erected; undrained and unexcavated rock to right

By Ewing Galloway, N.Y.

For the landward or easterly part of each of the slips 1, 2, and 3, earth and rock had to be removed to a depth of 46 feet below mean low tide level. To permit the removal of this rock, a cofferdam 2079 feet long,

brackish water for more than forty years. The part of this wall which extended across the site of Pier 90, has been left standing and will be used as part of the fill required to complete the pier.

Each of the new piers will consist structurally of two parts, namely: (a) the outermost part made of timber piles driven into the river silt, and (b) the landward part composed of natural rock, and rock fill retained by concrete walls. For the southernmost pier, No. 88, the pile part is 795 feet long, the natural rock and fill part 305 feet; for pier 90, the parts are 715 and 385 feet, respectively; and for pier 92, 655 and 445 feet, respectively. Both parts of each pier will have a concrete deck. Above this deck will appear a two-story standard pier-shed superstructure. It will be supported by concrete footings which will be independent of the deck. Reinforced concrete cross-wall fire stops will appear at intervals of 140 feet on the timber portion of the piers.

constructed of steel pile cells, was erected in the Hudson River along a line having a depth of 60 feet. The pile cells of the cofferdam were filled with clayey sand; the inshore side was also reinforced by a riprap embankment. When the river water, amounting to about 200,000,000 gallons, was pumped out behind the cofferdam, an area of about 15 acres was laid bare.

The surface of the rock as exposed over this area was somewhat uneven, but in general it sloped westward from 10 feet above sea level at the easterly margin of the pier sites to 46 feet below sea level along the inner margin of the rock fill behind the cofferdam. The amount of earth and rock which had to be removed from this area was immense. It com-

SITE OF NEW 1100-FOOT PIERS, OCTOBER, 1933

Rock portions of piers 88 and 90 are completed; concrete facing for pier 92 under way

Courtesy Dock Department, N. Y.





Fairchild Aerial Surveys, Inc.

VIEW OF PIERS 88, 90 AND 92, NORTH RIVER, NEW YORK, MAY 17, 1933

Pile part of piers, in river, outside cofferdam; rock portions of piers and excavations for slips, within a 15-acre enclosure. Photograph supplied by Allen N. Spooner and Son, contractors

prised 648,000 cubic yards, 508,000 cubic yards of rock, and 140,000 cubic yards of earth overburden. The methods used have been described in the August 3, 1933, issue of the *Engineering News Record*. It was accomplished by using a number of air compressors, a large number of drilling machines, a fleet of 30 ten-ton trucks, and a large force of men who worked day and night in three shifts of eight hours each, except from midnight Saturday to midnight Sunday. Along the pier and bulkhead walls the rock was line drilled to a depth of 46 feet with drill holes about 12 inches apart for a distance of about 2900 feet. Between these deep holes intermediate holes were drilled to a depth of 15 feet. The Jackhammer drill was the principal type of drill used in drilling the rock in the pier slips. The blasted rock was dumped by trucks on scows berthed outside the cofferdam. The excavation in Slip 3, the most northerly slip, was carried to a depth of

32 feet below sea level by June, 1933, and then delayed until October, 1933, when an additional 14 feet were removed to provide fill for those parts of the piers which are constructed of rock and reinforced concrete. The floor of each of the three slips is now 46 feet below mean low tide level.

During the excavation of the slips, the natural rock composing the bulkhead walls and intervening piers was left standing as nearly vertical as the conditions of the rock would permit. These rock precipices vary in height from 56 feet at the inshore end to zero at the distal ends near the cofferdam. The rock walls were excavated and benched to sound rock, upon which were built heavy gravity retaining walls. Where conditions made it necessary, battered walls were constructed, and in some portions, steel reinforcements were placed. The engineers propose that these concrete walls built upon the solid rock shall form the foundation for the concrete



By C. A. Reeds, N. Y.

WEDGE-SHAPED LEDGES OF MANHATTAN SCHIST, BULKHEAD WALL, NO. 3

Such V-shaped masses of hanging rock, thick at the top, and often unsupported at the bottom, gave rise to three rock slides along the bulkhead walls, extending from the foot of West 47th to West 52d Streets, New York City

deck and pier buildings which are to be erected.

The composition and structure of the rock varied from place to place in the excavations, and since rock slides occurred in the bulkhead walls of slips 2 and 3, geologists were called to examine and report upon the physical conditions of the rock. For this investigation the Allen N. Spooner & Son Construction Company, contractors, engaged the services of Dr. Charles P. Berkey of Columbia University, and Mr. John McKenzie, Commissioner of Docks of the City of New York, prevailed upon Dr. George H. Sherwood, Director of the American Museum of Natural History, to permit the present writer to represent the City.

In the discussion which follows, special consideration is given to the problem involved, the kinds of rock encountered, and an explanation is offered as to why the slides occurred.

The rock walls left standing for the pier

foundations were found to consist of two kinds of ancient rocks, each having a different origin. They may be designated the *Manhattan schist* and the *granite pegmatite*. The original characters of each of these kinds of rock have been changed or altered by processes of metamorphism. In addition to these two kinds of rock, a third kind was encountered on the surface, which may be called *unconsolidated deposits*, and described as follows:

When the river water behind the cofferdam was pumped out, it was found that the pier sites were covered with a mantle of loose rock composed of layers of glacial drift, river silt, and artificial fill, the combined thickness of which varied from five to more than ten feet. As this unconsolidated material was removed from the pier sites, glaciated rock surfaces were exposed. Many of these surfaces were uneven and exhibited typical rock hummocks, caused by the grinding and scouring action of glacial ice on rocks having

varied structures and different degrees of hardness.

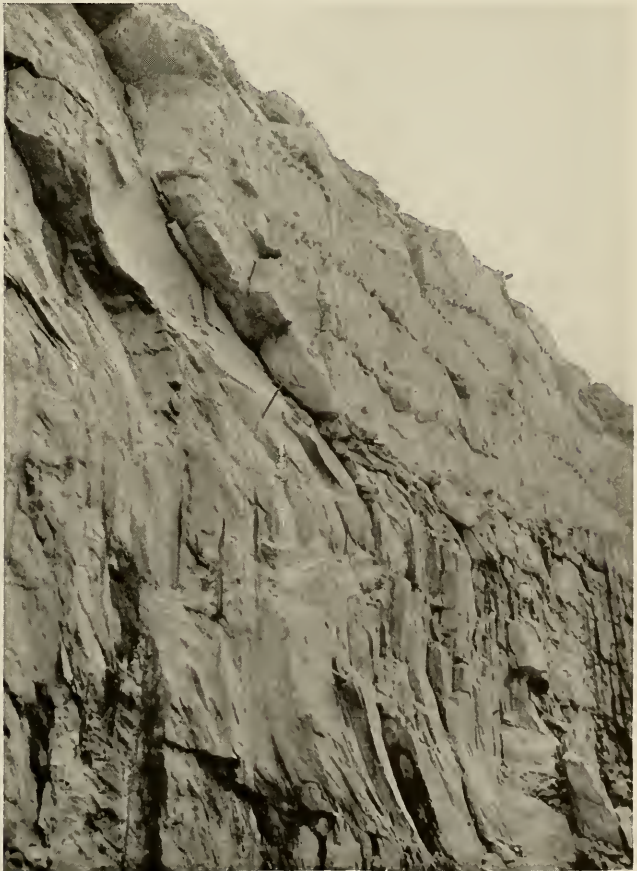
The Manhattan schist which is the predominant rock at the pier site, is the chief bed rock of Manhattan Island. It is frequently met in digging for the foundations of buildings and other structures. Its thickness at the pier site is not known. Borings in this rock in various parts of New York City have reached depths of 1224 feet, and in places it is estimated to be 3000 feet thick.

It is characterized by the following features: It is a dark schistose rock, streaked, strongly micaceous, coarsely crystalline, markedly foliated, and is composed essentially of the minerals biotite, quartz, and feldspar.

Red garnet in small crystals is the chief accessory mineral. In places epidote, cyanite, staurolite, and fibrolite are also present. The mineral combination and its structural features indicate that the schist was formed in ancient times by the metamorphism of sediments. This metamorphism of the original sediments must have taken place in the depths of a geosyncline, one of the stages in the evolution of mountains. To produce these features the materials must have been buried some five miles or more below the present surface of the earth, for in addition to closely appressed folds, they show flowage structures and oftentimes segregation of the quartz, feldspar, and mica ingredients into separate bands.

Where the Manhattan schist is unweathered, it affords good foundations for buildings. Where it is weath-

ered, it shows a brownish to rusty appearance caused by the oxidation of the iron present in the biotite. Weathered surfaces appear in the rock along joint planes and on surfaces which have been exposed for a long time. Where the surfaces show glacial markings, the weathering is slight and of no consequence. In long exposed surfaces the weathering may have reached depths of two to four feet, and in some narrow zones, even to forty feet. In fact, in some cases, the decay of the various mineral ingredients may have progressed to such an extent that the rock may be crumbled in the hand. On flat surfaces the decayed rock will carry a load, but on exposed vertical walls it will



By C. A. Reeds, N. Y.

WEDGE-SHAPED HANGING MASS OF GRANITE PEGMATITE Showing bulkhead wall, slip No. 3, foot of West 51st Street, New York City. The rock is steeply inclined and jointed



By Eric J. Baker, Elizabeth, N. J.

ROCK SLIDE, BULKHEAD WALL, SLIP NO. 2, FOOT OF WEST 49TH STREET, N. Y.

A hanging wedge-shaped mass of Manhattan schist, 75 feet long, slid into the 46-foot-deep excavation on April 28, 1933. Photograph supplied by Allen N. Spooner and Son, contractors

not do this unless it is reinforced.

The granite pegmatites, which are igneous in origin, are abundant in the pier walls, but they do not represent the major portion of the rock mass. They appear in the form of large and small dikes, sills, stringers, veins, and lenses cutting and penetrating the schist. Some of the dikes are from six inches to four feet across, others twelve to one hundred fifty feet in width. The more prominent of these features have been sketched diagrammatically in the accompanying isometric drawing of the pier and bulkhead walls.

The granite pegmatites invaded the Manhattan schist as molten masses of

rock and cooled slowly in the positions they now occupy. In some places the mineral ingredients are typical of a coarse-grained pinkish granite with the grains of quartz, feldspar, and mica scattered uniformly throughout the mass. In other areas they are abnormal in size, being one to two inches across, and appear as bands one or more feet in width, which run up and down through the rock. These large crystal developments are the typical pegmatites. They represent the ducts through which the hot vapors and gases escaped as the molten rock was cooling.

The presence of reddish orthoclase in the granite pegmatites suggest that they have sprung from a source common to the numerous dikes of red pegmatite

found elsewhere in New York City. Their geologic age is still problematical. If they are of the same age as the pegmatites at Bedford, Westchester County, New York, which have recently been determined by the radioactive method to be 380,000,000 years old, then these intrusive igneous rocks are of early Silurian age according to a recent radioactive chart of geologic time.¹ A like age has been recently determined by the same method for similar igneous rocks, namely: for the pegmatites at Branchville, Connecticut, 374,000,000 years, and for the granite at Fitchburg, Massa-

¹Reeds, Chester A., 1931. "How Old Is the Earth?" *NATURAL HISTORY*, Vol. XXXI, No. 2, and Guide Leaflet Series No. 75. American Museum of Natural History.

PEGMATITE SILL

Undulating surface exposed by rock slide, October, 1933. Bulkhead wall, No. 3, foot of W. 50th Street, New York, N. Y.



Courtesy of Dock Department, N. Y.

chusetts, 360,000,000 years.

The kinds of rock exposed in the site of the 1100-foot piers having been considered, it is well now to dwell briefly on the structural features of the area. The rocks have not only been folded and metamorphosed, but the folds have been so appressed that the rock ledges of the schist stand nearly on edge. The tops of the folds, moreover, have been so completely carried away by river and glacial ice erosion that only the basal parts of the former great folds remain. The axial trend of these folds is slightly east of north (N. 14° E.). In the Manhattan schist, the only rock present which shows banded structures, there are numerous pressure planes and foliation ledges. These dip westward toward the Hudson River at high angles which vary from 55 to 85 degrees, average 78 degrees. These structural features are more noticeable

in the bulkhead walls than in the rock faces left standing for the piers, for in the pier walls the ledges have been cut in cross section and are supported by adjacent ledges. In the bulkhead walls the ledges have been cut on a bevel and appear as sharply pointed long rock slivers, having wide tops and thin lower edges which, in walls 46 feet high, may remain unsupported for distances of 60 to 75 feet.

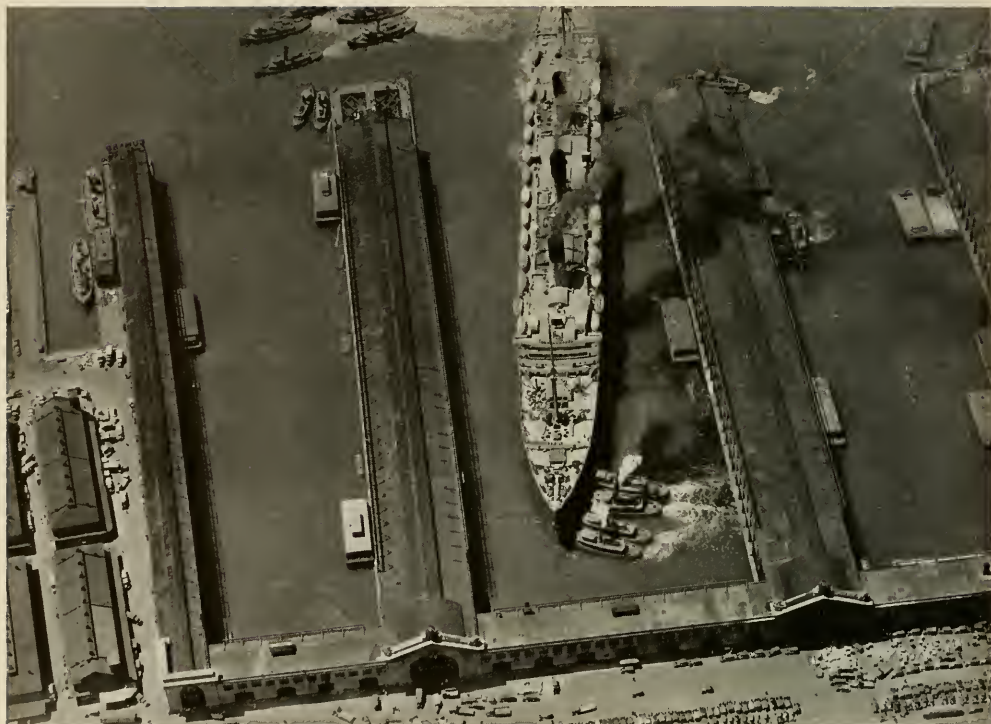
This slivered appearance of the schist in the bulkhead walls has come about through drilling the rock face in a north-east direction (N. 29° E.), and cutting the ledges at an angle of 15 degrees. Furthermore, the drill has gone vertically downward and cut across successive ledges pitched steeply toward the river; consequently, in the upper part of these newly made walls the ledges were cut, and wedge-shaped masses



BULKHEAD WALL OF 1890

Resting on bags of concrete, laid by divers on glaciated surface of granite pegmatite, Pier 90, foot of W. 50th Street, New York, N. Y. Photograph supplied by Allen N. Spooner and Son, contractors

By Eric J. Baker, Elizabeth, N. J.



Courtesy Cunard Line

By Airmap Corporation of America, N. Y.

S. S. BERENGARIA DOCKING AT PIER 54, NORTH RIVER, NEW YORK

Large transatlantic liners require numerous tug boats to warp them into position alongside the pier

of rock were left hanging on their schistose surfaces without sufficient basal support to insure a stable wall. The V-shaped outline of these attenuated hanging ledges is shown in cross section in accompanying photographs taken by the author, and in the diagrammatic representation of the structural features in slips 2 and 3.

These structural features, together with the presence of numerous intersecting joint planes, have caused slides to occur in some places along the bulkhead walls. In the northeast corner of slip 2 a large slide occurred April 28, 1933, which was some 75 feet in length and extended from Stations 800 to 875. The part of the wall which slid out was wedge-shaped in cross section, wide at the top with dimensions 15 to 25 feet in width, about 30 feet high, and intersected by a joint plane along the lower margin. When seen in May, 1933, the

inclined schistose plane was highly micaceous and wet with seeping ground water.

Just to the south of the great slide, evidence of another slide appeared between Stations 750 and 800. Here a comparatively smooth inclined surface intersected the line of the wall at an angle of about 15 degrees. A narrow pegmatite dike crossed it obliquely. Since drill marks showed only in the lower part of the wall, and the face of a prominent vertical joint appeared at Station 750, it was apparent that this smooth surface was a plane of schistosity, and that either at the time of blasting, or shortly after, a V-shaped mass of rock, wider at the top than at the bottom, slid into the excavation from the upper portion of the wall.

A slide of large proportions also developed in October, 1933, along the southeast part of the bulkhead wall of

slip 3. Steeply inclined schist ledges, which were unsupported along their lower margins for a distance of 75 feet, slid into the excavation. The inclined surface, which remained, was highly micaceous. An examination of the rock showed that it was the outer surface of an intruded sill of granite pegmatite. The thick sill extended to the bottom of the excavation and was found to be quite stable. In order that the wall line might be straight, this section, as well as the other places where slides occurred has now been faced with battered concrete walls.

Since all of the principal difficulties encountered in the construction of the new 1100-foot piers have now been briefly considered, it may be said that the excavation of the rock in the pier slips and the preparation of the foundations for the new piers have been large, expensive, and noteworthy undertakings. The engineering problems, although great, have not been insurmountable. The chief source of trouble was met in the bulkhead walls where wedge-shaped masses of rock unsupported at the base for distances of 60 to 75 feet either slid or had a tendency to slide into the excavation, some 46 to 56

feet in depth. These features together with numerous joints, which cut the ledges at intervals, caused at least three rock slides. These sections and some other parts of the pier and bulkhead rock-walls have now been reinforced with concrete walls, and it is not expected that any additional geologic or engineering problems will arise.

As this article goes to press, the rock foundations for the three new piers have been completed, the cofferdam is being removed, and the water is gradually being let into the pier slips. As the water rises, a man in a power boat with acetylene torch constantly skirts the pier and bulkhead walls. The blue flame which we see here and there denotes that he is cutting off bits of steel and iron, which project from the face of the reinforced concrete walls. Great skill, constant forethought, and supervision have entered into the construction of these huge structures. They are nearing completion, and as giant ships tie up alongside, incoming or departing passengers will seldom realize what the hand of man has wrought in building these new piers for the Port of New York.



S. S. MAJESTIC, Outward Bound, Hudson River, New York City



Peeling Green Bananas Preparatory to Boiling Them

“MAKANAN MALAYU”

Some of the Foods in Common Use Among the
Natives of Borneo and Celebes

By H. C. RAVEN

Associate Curator, Comparative and Human Anatomy, American Museum

AFTER six months in Borneo I began to enjoy Malay food. I recalled the words of a friend who had lived long in the East Indies, and who, when I was planning my trip there, told me that I had never yet tasted rice as good as that my Malay boys would prepare.

During the first three years I spent in the East Indies, my home for the greater part of the time was a small Malay perahu, and my only companions were a Chinese boy and two or three Malays, the crew of my boat. Samarinda, thirty miles up the Mahakkam River in eastern Borneo, was the starting-point from which I set out to collect natural history specimens. I usually spent several months at a time on such journeys, so, before starting, I provisioned my boat with most of the staple native foods.

Rice was the first consideration, and the best rice to be had at Samarinda at the time of my visit was imported from Siam by Chinese shop-keepers. In preparing for a six-months' trip I was told to provide

a kati ($1\frac{1}{3}$ lbs.) of rice per day for each person. As there were four natives and myself, that meant five kati per day or nine hundred kati (1,125 lbs.) for six months.

Next on my list was dried fish, the “ikan kring” of the Malays. This was composed of various kinds of marine fishes which were caught, cleaned, split open, salted, and sun-dried by sea-faring natives who lived in small boats or in houses built over the edges of the reefs. They sold or bartered the fish with the Chinese and Malay merchants up the river at Samarinda.

Other important food supplies were tea and sugar from Java, a jug of soy-bean sauce from China, and hundreds of pounds of salt from the Government godang, for in the Dutch East Indies salt is a Government monopoly. At the pasar, as the market is called, my boys bought “lombok kring” (dried peppers), each only about an inch long but very hot, and a great variety of spices, many

of which I know only by their Malay names. Most important among them were "kunyit" (turmeric), "jintan hitam" and "jintan putih," "langquas," "sahang hitam" (black pepper), sahang putih" (white pepper), white, yellow, and red onions, and a box of "assam Jawa" (tamarind).

We also took with us several dozen duck eggs coated with a mixture of damp wood ashes and salt. Enough of the salt penetrated the shell to preserve the egg and also to savor it so that none need be added when it was cooked.

The morning of the day I left Samarinda I sent the boys to the pasar to buy bunches of bananas, some green, others partly ripened, and any other kinds of fruit that might be in season. We also bought live chickens, which were carried on deck tethered by one leg or hung over the stern of the boat in a light rattan basket made especially for the purpose.

We needed many cocoanuts, but these always grow best near the coast. We

therefore stopped at a native plantation near the mouth of the river and purchased one hundred cocoanuts, which were duly stored beneath the floor of the perahu.

I remember well the first time I sailed out one of the mouths of the Mahakkam delta. The perahu moved swiftly, for added to the current of the river was a strong ebb tide. With clumsy oars the crew worked the perahu close in to the muddy bank, where there was a dense growth of nipa palms. As we were carried along, they quickly cut some nipa leaves to use as fish lures, then maneuvered away from the bank to avoid the overhanging branches and sharp roots beneath the water.

A few minutes later we were out of the river and we put up sail. The sky was low and gray, and as I watched the fin of a large shark cutting through the water near by, one of the Malays occupied himself with carving two or three pieces of nipa leaf crudely in the form of a fish. We kept to the channel for a mile or



PREPARING SAGO

The pith of the sago palm was put into the troughlike palm stem, the base of which was covered with fiber. Water dipped from the stream with a long-handled scoop was poured over it. It was then jounced up and down until the water and starchy sago suspended in it worked through the netlike fibers and dropped into the canoe, where the pure sago settled to the bottom.

more beyond the limit of the nipa, then sailed northward over the flats. In a short time we had left behind the muddy waters from the river and were sailing over coral reefs. By that time the fish-shaped nipa lures had been attached to a line which carried a crude bronze fishhook and a lead sinker.

As the line was paid out I noticed that the lure darted back and forth and looked very like a fish swimming through the water. When Nia, who was steering with one foot on the tiller, had paid out sufficient line, he made it fast by giving it a double turn around his big toe. One of the boys got out a few sticks of mangrove wood from below the floor and proceeded to make a fire on our very simple portable fireplace, which was constructed by cutting a five-gallon oil tin in half

lengthwise, putting the two halves together to form a square container, and then filling it with sand. Another boy was diligently picking over the rice he had measured out for our evening meal, to rid it of any hulls or dirt that might be there.

Suddenly there was a tug at the line on Nia's toe. At the time, he was sitting on the deck with the fishing line still twisted around his toe. With the other foot he was holding the tiller, while with his left hand he steadied half a cocoanut which he was shredding with a scallop shell. He

dropped shell and cocoanut, grabbed the fish-line, and began pulling in on it while we all looked on. The fish was soon hauled skillfully on deck and immediately dispatched by a blow on the head with a parang (large Malay knife). It was a

member of the bass family and about two feet long.

A few minutes later the rice was poured into the water, now almost boiling in the thick iron rice-pot. It boiled furiously for several minutes, after which one of the boys tasted it, decided it had boiled enough, killed the fire, took the pot off the iron ring and set it down on the embers, banking them about the pot. In this way the rice continues to cook and to use up the surplus moisture but does not burn.

A few minutes more and the rice-pot was set aside

without being stirred, the fire built afresh, and a saucepan of water put on. Into the water several varieties of spices were put, most important among them the turmeric and peppers, to which tamarind, onion, and salt were added. Into this mixture the cook put part of the fish, which had been carefully cleaned and cut into pieces, and boiled it for a short time. Fish prepared in this way they call "ikan pindang." In a little kettle with a tight cover to keep out smoke they boiled water for tea.



POUNDING RICE

The steady beat of the wooden pestles in the heavy wooden mortars is a familiar and pleasant sound remembered by all who have spent much time in Malaysia. Here four girls are shown pounding in one mortar. This requires more than usual dexterity and rhythm

When all was ready, they served the rice heaped on a soup plate. Another dish contained the boiled fish with some of the water in which it had been cooked. On a small saucer was put about a table-spoonful of "sambal," consisting of the tabasco peppers, salt, a bit of onion, and a bit of lemon that had been mashed together on a slightly concave wooden mortar. As is the usual custom in the East Indies I ate this meal with a soup spoon instead of with a fork. The Malays used only the fingers of the right hand, and used them with extreme skill and daintiness, so that no rice or other food was spilled. My Malay boys were very polite and would not eat their meal until after I had finished mine. They noticed that I did not partake of any of the water in which the fish had been cooked, and later told me that it was good. I was surprised to find it delicious.

For dessert after such a meal of rice and fish I ate bananas or mangoes or whatever fruit we happened to have. Many times I have heard my Malays tell others that I did not know how to drink cold water, for I drank only tea and that three or four times a day.

Of course, during the first few months of my stay in the East Indies, I learned to know only a few of their many foods and their ways of preparing them. In course

of time, however, I found that my boys could usually obtain a fair variety of food even when we lived far from gardens. When we sailed along the coast, they were always on the lookout for fish which might come within range of their spears, and sometimes when we stopped at suitable places, they put out seines and caught quantities of a large sea-mullet, which we salted and dried in the sun for use when we went inland. On the shores of little islands we dug for the eggs of sea-turtles, sometimes getting more than two hundred eggs from a single nest. These eggs kept

very well stored in the bottom of the boat, and I usually ate five of them at a meal. The flavor is peculiar but not unpleasant and, unlike hen's eggs, the white does not solidify when boiled.

For meat the natives depend on hunting. One afternoon we left the perahu and went out with a native guide to jack for deer in some deserted clearings a few miles inland. One of the boys carried rice, dried fish, salt, peppers, and tea, also our iron rice-pot, saucepan, teakettle, and three-legged iron ring for a pot-stand.

We reached the edge of the clearing just at sunset and the boys immediately made a fire and cooked our evening meal, which consisted of rice, roasted dried fish, and "saioer pakis," a fern that grows along the banks of streams in Borneo and one



GRATING A COCOANUT

When the cocoanut is grated, a little water is added and the gratings squeezed by hand. The result is a milk-white fluid containing the oil and the flavor of the cocoanut. This sauce is added to various vegetables after they have been boiled



PREPARING A FEAST

On such occasions food is cooked in pots and green bamboo. It is served on woven rattan stands covered with a piece of green banana leaf

small joint of bamboo fastened to his belt one of the Malays took salt and hot peppers that had been pounded together. He rubbed this into the venison, which was then put on a green stick over the fire. While it was roasting, one of the boys

of the commonest green vegetables to be had. The natives pick the tender tops of the leaves, wash them carefully, then boil them just as we boil spinach. After a few minutes the water is poured off and the milk squeezed from a freshly grated cocoanut poured on: hot peppers as well as salt are added, and the vegetable is allowed to cook a little more. The rice, the fish, and the vegetable were all served on separate plates,—a simple, tasty, and satisfying meal.

That night about eight o'clock we began our hunt for deer. I carried the jack-light, a Belgian wall-lamp which burned kerosene and had a large metal reflector. Behind me walked a boy carrying my gun, and behind him was the boy with the rest of our kit. On this occasion we hunted nearly all night without getting a shot. We were wearing thin cotton clothing, and the dew had given us a cold bath as we pushed through the dripping second-growth. Finally, just before dawn I "shined" the eye of a sambar deer only a short distance away and shot him. We sat beside the carcass to await the coming of daylight.

We were very hungry, and, as soon as the heat had passed from the body of the deer, which was a young one, we skinned it and cut up some of the meat. From a

gathered lemons, which we squeezed over the meat before serving. I believe that venison was as fine as any food I have ever tasted.

From a part of the deer the boys made "sate," which was prepared by cutting the meat into pieces about the size of the end of the thumb, seasoning it with salt, peppers, and other spices, and spitting it on fine sticks or slivers of bamboo a foot or more in length. It was then placed over the fire to roast slowly. "Sate" is delicious, and as it is dry, it keeps perfectly for many days in the humid climate where meat ordinarily spoils quickly.

Another much prized food source is the sugar-palm. One day on the coast of Celebes we met a native collecting the sap from this tree. He climbed up the trunk, cut off a bunch of the young fruit, and then fastened a piece of bamboo to the butt so that the juice dripped into it from the cut stem. After he came down we walked along with him to his hut. He was carrying another piece of bamboo already filled with the sap, which had a sweetish odor and was the color of water with a little milk in it. When we reached the hut, he uncovered a large cauldron over the fireplace and added the liquid in his bamboo to the contents of the pot. This, after boiling, would be the native

"gula merah," literally red-sugar but generally called palm-sugar. He brought me some cakes of the palm-sugar, rich brown in color like dark maple sugar, which it also resembled in consistency. It had a very pleasant taste, quite as good as maple sugar but very different. He also gave me the juice of the palm to drink. The fresh juice is rather insipid and sweet, but the natives usually let it ferment before they drink it. Then it becomes more like hard cider, and to judge by its effect contains a fair percentage of alcohol.

Sago is another staple article of food in the East Indies. I once watched two men preparing it in a swamp close to my camp. They chose a tree which was just about to bear fruit and had a fairly good trunk. After felling the tree they hacked off the leaves, to be used for roofing mats. Then they split the trunk, which contained hundreds of pounds of sago starch imbedded in dense fibers near the outside but almost pure sago in the center. To gouge out the pithy mass they used a mallet, the head of which, about eight inches long, was made from the trunk of the betel-nut palm, and the handle from hardwood sapling. They had rigged up a small dug-out canoe over a near-by stream, and beside this made a little platform of palm stems on which one of them could stand. Above this platform and at a right angle to the canoe they fixed the trough-shaped stem of one of the very large leaves, to the base of which was attached some of the meshlike

fibers that grew on the trunk. The other ends of these meshlike fibers were gathered together and fastened to the ends of two long saplings that had been driven into the ground on the bank, then arched over so that they acted as a spring to hold up the fiber bag. In crude baskets made of the leaves the pith was brought out of the swamp, then put into the trough a little at a time, while over it was poured water dipped from the stream with a long-handled scoop. It was then jounced up and down until the water and starchy sago suspended in it worked through the netlike fibers and dropped into the canoe. The coarse fibers remaining in the trough were thrown aside and replaced by more pith, and this was continued until all the pith had been worked over. As the water with the sago flowed into the canoe, the sago gradually settled at the bottom, as starch naturally does in water. Finally the canoe was tilted, the surplus water spilled out, and the pure buffy-white sago remained. Containers, each holding about thirty or forty pounds of sago, were made from sheets of the barklike fiber that surrounded the trunk of the same sago-palm.

A family of Kaili people in Celebes with whom I once stayed cooked sago for me. They lived in a palm-leaf hut, the

PUMPKIN AS A VEGETABLE

It is peeled and cut into rather large pieces, boiled first in water, then in coconut milk, and finally seasoned with salt and hot peppers



floor of which was several feet above the ground. On the earth of their fireplace were five water-worn stones arranged in a rectangle with one in the center. All their cooking utensils were rounded on the bottom and the stones were arranged to hold two pots. However, to cook sago for me the Kaili woman used three evenly-concave baked clay plates but only one triangle of stones. She put all three plates over the fire at once until all were hot. Then the upper plates were removed, while a layer of crumbly sago half an inch deep was sprinkled on the remaining one. Over the sago she sprinkled palm sugar, patting it down with the bottom of the second plate, on which more sago and sugar were placed. The same process was repeated for plate number three. Then the sago pancake on plate number one was transferred, bottom-side-up, to the uppermost plate, and all the pancakes thus juggled about until each was done. Plate number one was always returned to its place next the fire, however, for its underside was blackened. It seemed to me that the woman had hardly allowed them to cook at all, and yet, when eaten, they proved to be palatable, chewy, and well mixed with the delicious palm-sugar.

Fruit is, of course, one of the main articles of food in all tropical countries. The mango, the mangosteen, the rambutan, which is a fruit with a hairy rind and grapelike center, and the durian, all make delicious additions to the menu or, upon occasion, complete and satisfying meals. I shall never forget hunting

alone or with a Dyak companion in the great forest of central Borneo during the height of an exceptionally fine fruit season. I would leave camp early in the morning, carrying a shot-gun, a machete in a wooden sheath on my belt, and a very light Dyak basket on my back. In the basket was my luncheon, consisting of some cold boiled rice rolled in leaves, a piece of roasted meat, and peppers and salt ground together.

Many times I remember stalking cautiously along pig trails through the idle forest of mid-morning or early afternoon, when suddenly the delicious fragrance of durian would come to me on the almost imperceptibly moving air. That fragrance of durian was unmistakable and I immediately followed the scent. On one occasion we followed it for some distance, then lost it as the slight current of air shifted. We worked back and forth until we again met the fragrant current, which grew stronger as we approached its source, but we walked more than a mile before coming to the tree. This was not the common green durian but a variety rich orange in color and still more delicious, which was called "lay." "Duri" in Malay means spine or thorn, and "durian" that which is covered with

spines. Inside the spiny rinds the creamy flesh surrounds seeds as large as a horse-chestnut. Sometimes we made rattan baskets in which we carried the fruit back to camp with us. Many times I returned to camp with my luncheon untouched, having feasted instead on one or another variety of this delicious fruit.



SAGO PALMS



The Caribbean Meets the Foothills of the Sierras

JUNGLE AND SNOW IN COLOMBIA

Studying the Plant Life and Climbing the Mountains
in Northern South America

By EDWARD A. SCHUMANN, JR.

PHOTOGRAPHS BY WILLIAM SEIFRIZ

THE snowy crests of the Cordillera of the Sierra Nevada de Santa Marta in Colombia are visible from quite a distance at sea, and, during the dry season when they are not hidden by canopies of clouds, offer a reliable landmark to ships putting into Santa Marta, the port of the Sierras.

Despite its proximity to the Andes, this range is entirely independent of them. "In general structure," say Todd and Carikker, "and in the character of its rock formations, the Sierra Nevada resembles most other sections of the old land found in the Caribbean region, and there is reason to believe that at one time it constituted a part of the Antillean land mass of which the islands of Curacao, Aruba, etc., are also remnants."

This highland wilderness offers a veritable wealth of opportunities alike to scientists and explorers. Its cool paramos are inhabited by a curious Indian folk who

have never been known to mingle with civilization. Their little empire in the hills functions today probably just as it did in pre-Columbian times.

Beyond the humid, fever-ridden littoral the mountains lift their virgin summits to the height of perennial snow. Incidentally, I believe this to be the only group of mountains between Alaska and the Andes that has not been visited by mountaineers.

In the summer of 1932 Prof. William Seifrizz, of the botanical department of the University of Pennsylvania, led an expedition into the Sierras for the purpose of collecting and studying the flora peculiar to the region, and to make an attempt to reach the virgin summit of an unnamed peak. I am indebted to him for the use of the botanical information and the photographs used in this article.

Of the two routes leading from Santa Marta to the heart of the Cordillera we



CARIB HOUSES IN DIBULLA

Most of the dwellings consist of mud walls reinforced by wattles and have thatched roofs. Except for their shapes, they are identical with the Indian huts, even to the extent of not having smoke holes in the roof

decided upon the one taking us by way of the sea, feeling that we would have greater access to the floral growth than by taking the southern route over extremely arid land.

We made our base at Dibulla, a typical dingy settlement of the American tropics. The ubiquitous pigs dispose of its sewage after the customary tropical fashion, and were it not for hordes of starving dogs and fowl, the pigs would hardly suffice.

The government has made no effort to mitigate the scourge of malarial fever. The native vitality has been sapped through so many generations by malaria that the oldest die young and the children acquire the disease long before maturity. Some have a vague idea as to the origin of the disease but most are of the opinion that the night air is the culprit.

In the semi-arid vicinity about Dibulla grow several varieties of cactus, including the tall, slender cereus, which often

attains a height of twenty feet; the small barrel cactus (*Echinocactus*); and the "prickly pear" cactus (*Opuntia ficus-indica*). None of these contain drinking water, and the thirsty traveler is not a little disappointed, upon incising them, to discover a mucousy secretion.

The most common tree is the Acacia, a small-leaved, low tree belonging to the legume family. It and its cousins are found the world over in hot and very dry countries.

Upon turning into the lowland jungle one finds a marked change of environment. We met the palmiche palm in great abundance. With it occur the calabash tree (*Crescentia cujete*), and more rarely the bottle tree (*Sterculia rupestris*) with its bulging trunk. A small tree known as the sea grape is not uncommon.

As we advanced farther into the forest, nature's manifestation of the survival of the fittest became more apparent. A

specific case in point is the "strangling" fig, a climber that clings to the trunks of trees. As this "strangler" grows, it sends out shoots which eventually envelop the trunk of its support, mercilessly choking it to death.

Many varieties of orchids lend fragrance to the jungle paradise. Some orchids are epiphytic plants; that is, they attach themselves to other plants but do not derive nutrition from them. Because of this habit orchids appear in the most unsuspected places, often growing well up the trunks of trees. Other epiphytic plants, the tank bromelias, are to be seen swinging like large pineapples among the branches and network of the twisting lianas.

Very common herbaceous plants on the forest floor are the wild gingers and the closely related member of the banana family, *Heliconia*, with gorgeous red and orange inflorescences. Everywhere among the trees the hanging "Spanish moss" (*Tillandsia usneoides*), (which is not a moss) is abundant.

Perhaps the most delicate and graceful of all the trees is the tree fern which occurs at altitudes between 3000 and 4000 feet.

The forest is rich in bird, reptile, and insect life, but the larger animals are scarce, with the exception of monkeys, troops of which keep the lofty tree tops alive with their raucous chatter. Small lizards and iguanas skelter away to safety quicker than the eye can follow. Poisonous serpents are not uncommon, and for that reason we had taken care to carry with us a liberal supply of anti-venom. However, there was no occasion to use the serum, as the only snakes seen were two specimens of the fer-de-lance, entwined in the branches of trees.

The forest ends at Pueblo Viejo, a tiny Colombian settlement of a dozen or so huts, whose chief occupation is the manufacture of panela, a crude, brown sugar which is sold to the Indians. Pueblo Viejo also marks the beginning of the paramo as well as a limit of the Indian Reservation.

After leaving Pueblo Viejo, we ascended a steep hill and arrived at the valley of the Rio Ancho, or the valley of the treacherous and sinister witch people against whose craft we had been warned by the women in Dibulla. This suspicion on the part of the Colombians is quite unjustified, but is easily accounted for by the fact that the Indians seldom, if ever, show themselves on the coast and are therefore enshrouded in mystery.

The great, bare, stony slopes seen from



A PORTER

These men are loyal and faithful. For the price of a necklace of roseate carnelian, they cheerfully endured the cold and mountain sickness of the high Sierras



SAN MIGUEL

The Metropolis of the Arjuacos. The cluster of beehive-shaped huts, nestling in its valley between the wooded hills, is surrounded by a wooden wall to bar out the domestic animals



A HIGH PRIEST

The chief priests or "mamas" are often consulted by their people and occasionally by coast dwellers upon matters of health and business. This mama was very shy and could be induced to appear only when promised gifts. It is said that no white man has ever been permitted to enter a temple



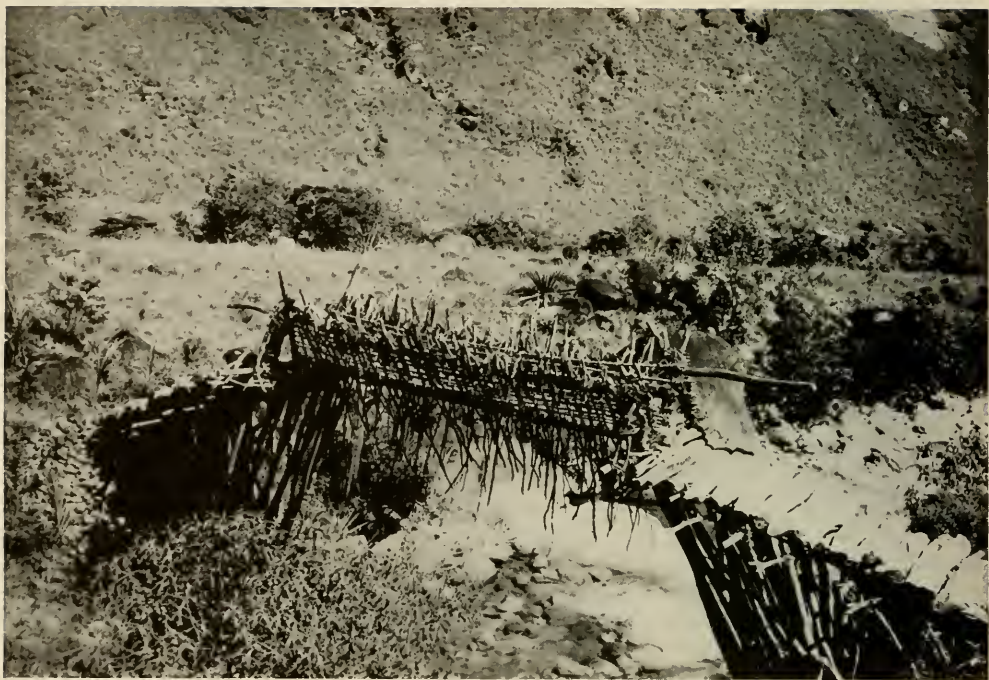
TEMPLE AT TAGUINA

Taguina, like Macotama, is a religious center. Note the construction of the apex of the temple and compare with those at San Miguel. The purpose of this adornment remained a mystery



PRIESTS AT MACOTAMA

Macotama is an Indian shrine consisting of a little group of grass temples and a rock ledge, upon which rest scores of tiny stone pyramids. The priests erect these at the request of travelers, and it is believed that when a pyramid falls, the one for whom it was built will die



A CANTILEVER BRIDGE

Several of these bridges span the Rio Ancho near San Miguel. Their permanence and rigidity attest the engineering skill of the Indians

the summit of the hill offered quite a distinct contrast to the mellow, wooded hillsides of the jungles. Far below could be heard the droning of the turbulent Rio Ancho, fighting its way to the sea. One felt as though one were far from the tropics, for nothing was indicative of the luxurious warmth and languor of the southland.

Somewhere near the head of the valley lies the Indian village San Miguel, which, we had been told, would be difficult to see even when we should arrive in its vicinity. This information proved to be correct even to the extent of its being hard to see the individual huts that were scattered all along the valley bed.

Occasionally there appeared behind clumps of plantain stalks what seemed to be giant toadstools, blackened and sagged with age. These are the "rozas" or farms of the Indians, where they raise bananas, yams, arracacha, and yucca.

Higher in the valley they grow tobacco, coca, corn, and beans.

Late in the afternoon we saw the black, conical roofs of San Miguel peering out from behind a dense plantain thicket. The village lies on a high plateau opposite the bank on which we were. By way of gaining the plateau, we crossed the Ancho over a bridge of interesting construction. That the Arjuacos have a sound knowledge of mechanics is attested by this wooden cantilever bridge and the manner in which they firmly secured the beams without using a bit of metal.

Upon entering the village we were somewhat amazed to find it abandoned, and wondered what would be the nature of our reception. Later we learned that the inhabitants only visit the village on festive occasions such as religious ceremonies or funerals or even the arrival of a group of white men—an extremely rare occasion.

Our eyes fell upon a myriad of queer little huts arranged in a most haphazard way, there apparently being no discrimination between the dwellings of the authorities and those of the common people. With fantastic religious adornments atop their conical grass roofs, these huts bore testimony to the isolation of their builders from the rest of the world.

The guide led us to a rather large, rectangular house built especially for foreigners. A similar but slightly larger edifice stood not fifty feet from our door. This was opened only once a year when it harbored the curate from Bogotá, commissioned by the government to say Mass to the Indians.

Toward dusk, Indians could be seen cautiously making their way toward the center of the village, avoiding our sight by darting behind huts to reach the sanctuary of the men's house and to be reassured by their commissioner of our pacific intentions.

Like their dwellings, the Arjuacos presented a spectral appearance as they shyly approached the interior of the foreigners' house where a small fire cast a shimmering glow upon their pronounced features, causing them to appear like dwarfish, aged Mongolians. Long and very black unkempt hair fell down well below their shoulders. They were attired in cotton robes cut very like nightgowns; some wore trousers of the same material which hung high above the ankles. The cloth of which these garments are made is spun by the men, but it is to be doubted whether their clothes are ever washed or mended.

We brought out some rum, obtained in Pueblo Viejo for distribution among the Indians.

They were reticent and timid and very suspicious of our motives until they had a few drinks, when they became somewhat more loquacious and reveled in joyous fraternity. Even when intoxicated, they did not resort to fighting, beyond a mild wrestling and pulling of one another's hair.

In a few hours we had come to a friendly understanding with these natives and proceeded to observe their manners and ways of life. So long as we had rum and gifts they were only too willing to assist us quietly.

The Arjuaco is an inveterate coca addict and is never seen without his lime-containing gourd and bag of coca leaves (*Erythroxylum coca*). A pinch of leaves is placed in the mouth and continuously



THE BRIDGE IN DETAIL

This shows the manner in which the bridge members are joined together with withes by the skilled workers of the Arjuacos



THE EXPEDITION'S BASE AND HOSPITAL IN PUEBLO VIEJO

Those of the party who suffered from malarial fever will never forget the hospitality of their Colombian hosts during their occupation of this hut

chewed in a bovine manner. A long stick is then rattled about in the sugi (gourd) and presently brought out with its blunt end covered with the lime obtained from burning sea shells, and placed far back in the mouth to join the coca. When the stick is brought out of the mouth, it is tapped and rubbed upon the neck of the sugi. This continual deposition of lime and saliva upon the neck of the gourd results in the formation of a large, yellow-green, calciferous collar.

Leaving San Miguel, we proceeded toward the great unclimbed and unnamed peak.

In the Cordillera there is a very short dry season—a period of two weeks known as the “*veranito*,” or little summer, which sets in toward the first third of the rainy season. It was during this short spell that we had hoped to be climbing, and in order to move more expeditiously we had procured from an old man two

bullocks and three porters for a single string of carnelian roseate beads, dug up from an ancient Taironan grave near the coast. We miscalculated the period of the “*veranito*,” however, and arrived upon the scene of attack too late. The most important factor in a successful ascent is the weather which, in our case, was becoming increasingly disagreeable. Notwithstanding this handicap, our party, eight in number, departed from the village via the rear gate, passed through a grazing plot, and made our way up a steep forbidding valley, whose barrenness and sheer flanks of black rock inspired in us a certain awe. Our direction now took us nearly due west—to the source of the Rio Ancho.

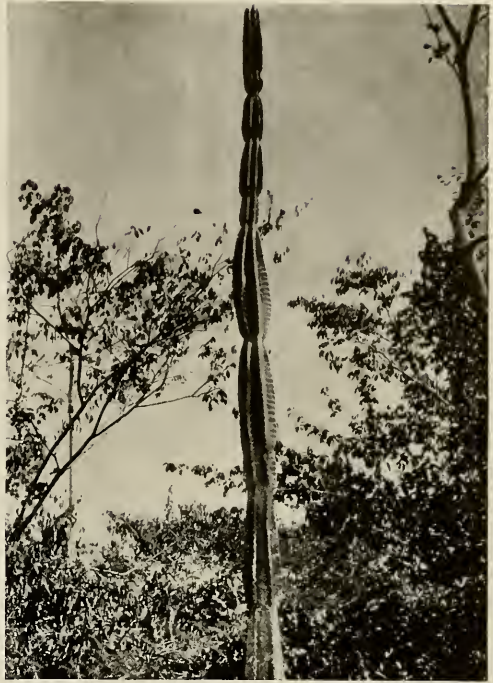
The contour of the southern ridge was jagged and saw-toothed. The age and composition of the rock account for the obvious erosion of the peaks and the valley bed. The walls of heterogeneous

strata were evidence of the turmoil that took place when the range was coming into existence.

We traversed two Arjuaco religious centers—Taguina and Macotama—where we paid our respects to the *mamas* or high priests who delighted in several “trinkies” from our coveted canteens. The *mamas*’ lives are restricted to their ecclesiastical duties from early childhood until death, but they are often consulted by their people and occasionally by coast dwellers upon health and business difficulties.

We passed the first night in an abandoned *rosa* at an altitude of 9200 feet. Rain and cold harried us all through the night.

Crossing the cataracts of the Rio Ancho was very difficult, because of the swiftness of the current and the chasm that yawned beneath. After scrambling up slopes covered with a bristly thorn



A TWENTY-FOOTER

The cacti at Santa Marta are chiefly the tall, slender, and branched *Cereus*



CLIMBING BAMBOO IN BLOSSOM

This bamboo grows for thirty-two years, at the end of which time it blossoms and dies

bush, we came upon our last shelter—12,600 feet. It was necessary to leave the animals here. We now found conditions less favorable than on the preceding evening. No dry firewood could be found. The roofs and walls of our two huts were riddled with holes. They had no doors so that the icy wind swept through, blowing shrill tunes as it whistled as well through the tiny chinks. The Indians left and shortly returned with armfuls of long pampas grass with which they patched these holes. Those worthy souls labored diligently trying to make the hovels as cozy as they could, and I dread to think of the evening we might have passed had the old man in San Miguel refused our offer of the stone necklace.

That night was one of misery and seemed unending. The billowing smoke from the smoldering fire, finding no exit, settled in a dense cloud not more than a



A COFFEE PLANTATION AT SUNRISE

The tall, umbrella-like trees in the foreground are known as shelter trees and are profusely distributed about the plantation to shade the coffee plants

foot above the ground. The rasping fumes stung our eyes and burned our throats until asphyxiation seemed certain should we remain within. Outside, the wind, accompanied by flurries of snow, made us feel that it was best to brave the smoke for the warmth. There was no alternative. We huddled around the fire and put our noses to the ground, but the dank earth and the frigid drafts absolutely sealed our fate. No sleep that night! What little oxygen there was was consumed by the fire, leaving us to gasp and inhale as deeply as we could.

The moon passed the meridian at about 4:00 o'clock in the morning, and its silver sheen momentarily made us forget our discomfort. Wondering whether there was enough light to discern our goal, and feeling that now it should be in view, I arose and peered out of the door. The magnificence of the spectacle made me catch my breath, for there, bathed in the



THE TREE FERN—PARAGON OF ARBOREAL BEAUTY

The tree fern grows in many tropical countries. Science has found that the rootstock contains valuable oils and filicic acid. Tree ferns yield a kind of sago which can be utilized in times of famine



THE LEFT WALL OF THE COL

Maps place the peak directly to the left in relation to the photograph. As the explorers were not very familiar with the topography, and were greatly handicapped by the weather, they sought the peak to the south, or toward the reader

ethereal light of the moon, the majestic silver summit rose from behind spires and jagged pinnacles of black rock. The scintillating stars of the winter constellations enhanced the scenic splendor, causing me to feel as though I was standing upon the very roof of the world. As the sky grew orange, a sea of cloud floated over the valley, blotting out the distant lowlands and the Caribbean.

But dawn never broke—it was almost as if we had seen the sun for the last time. Breakfast was soon prepared and final instructions were given to the Indians. Today we were to dash to the top. We dressed in our warmest clothes and donned our high, cleated shoes. We left a man behind to keep camp and guard the animals. Our course was northeast, bearing toward the source of the Rio Ancho. The journey bore us over nearly vertical rock walls. Progress was slow because of



AT 17,500 FEET

Climbing at this point was not difficult. The visibility, however, was so poor at times that it was impossible to see farther than one hundred feet

the difficulty in breathing, but we gained altitude rapidly and soon found ourselves at the edge of Macotoma Lake, 14,400 feet. This large horseshoe-shaped freshwater lake is the reservoir of the Rio Ancho, it being fed from the melting ice and snow above as well as by the overflow from another lake some thousand feet above it.

The weather grew steadily worse while the wind assumed the velocity of a gale. The vista was literally blanketed by clouds and snow and our outlook was dubious. If here in the trough the storm was so severe, what must it be like on the exposed ridge ahead of us?

Fatigue began to hinder progress noticeably, and it became imperative for us to stop frequently to recover our breath. Snow pits were numerous and each had to be tested with ice-picks before setting foot upon it.

Upon reaching the col Doctor Seifríz and I left our companions and proceeded alone. Diego, the porter, loyal to the last, was freezing when we left him to turn back from the col, where the cold had

very nearly paralyzed his bare feet.

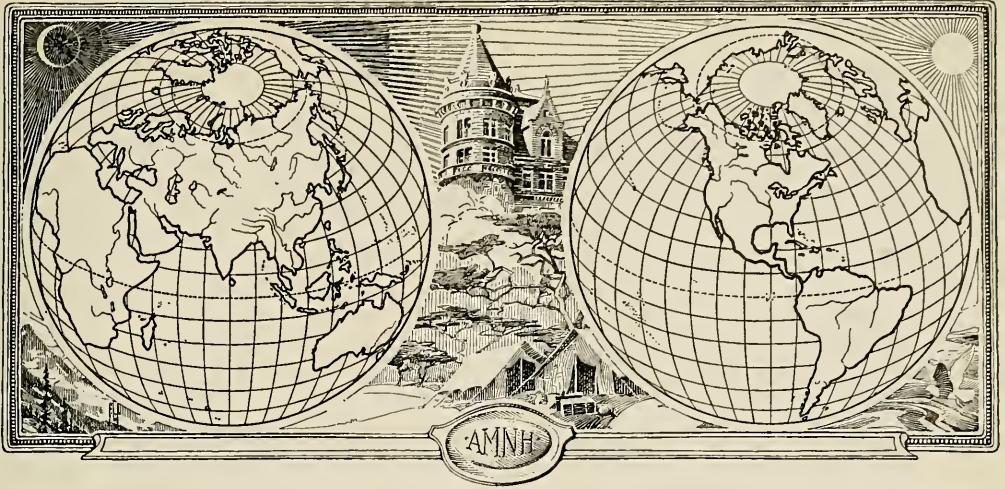
At the col we found ourselves confronted by a sheer drop of ice-coated rock. To attempt a descent would have been a more than dangerous undertaking in such weather, so we decided to climb along the ridge to the south and attain as much altitude as possible in the hope of availing ourselves of a position from which we could get bearings.

We began operations on the western face of a tall tower, but before long we realized that further progress would be in vain because of the precarious state of the rock and the exposure to the wind, and so decided to abandon the attempt. The intense cold had penetrated our clothes. We reluctantly gave up without having ever seen our peak or even the glacier at its base, in spite of the fact that we stopped at an altitude of slightly less than 18,000 feet, 2000 feet less than the top of the mountain.

Troubles in camp arose, and, with the weather against us, our only alternative was to return to San Miguel, leaving the peak still unconquered.



THE SNOW CRESTS OF THE SIERRAS AS SEEN FROM A HILLTOP, JUST OUTSIDE OF SANTA MARTA



SCIENCE IN FIELD AND LABORATORY

Expeditions—American Museum Activities—Education—
Meetings of Societies—New Publications

EDITED BY A. KATHERINE BERGER

"TINGMISSARTOQ" THE LINDBERGH PLANE

ON completing their recent 30,000-mile survey of the Atlantic Ocean and twenty-one countries in the plane "Tingmissartok," Charles A. Lindbergh and Anne M. Lindbergh presented to the American Museum of Natural History the plane and all equipment used by them in this exploratory flight. The plane is the same one in which the Lindberghs made a record flight from Los Angeles to New York in 14 hours and 45 minutes in April, 1930, and in which they flew to China by way of Alaska in 1931. The name "Tingmissartok" in the Eskimo language means "The one who flies like a great bird." Colonel Lindbergh, in giving this explanation to the writer stated, however, that Vilhjalmur Stefansson, the Arctic explorer, would place a slightly different interpretation on the meaning of the word. Whatever may be the significance of the name, the donation of such an exhibit is unique in the annals of the American Museum.

On previous occasions, trophies of other explorations have been presented to the Museum; for instance, the dog sledge on which the late Admiral Robert E. Peary reached the North Pole, April 8, 1909, as well as the sledge on which Roald Amundsen discovered the South Pole, December 14, 1911. Memorabilia of the Amundsen-Ellsworth flight across the North Pole, in the airship "Norge," May, 1926, have also been donated to the Museum. These Polar exhibits

have been placed in special cases in the pre-geographic hall on the first floor of the Museum building.

Colonel Lindbergh in conversation with Dr. F. Trubee Davison, president of the Museum, made the presentation of the "Tingmissartok" and all equipment used in the 1930, 1931, and 1933 flights, on December 21, 1933. Following a conversation between Colonel Lindbergh, Dr. George H. Sherwood, director of the Museum, Roy Chapman Andrews, vice-director, and other Museum officials, the Museum decided to place the plane and equipment in the large Hall of Ocean Life, alongside skeletons and restorations of whales, porpoises, walruses, seals, coral reefs, and various kinds of shell fish. When the Museum can realize its program for the construction of additional wings to the present building, the plane, its equipment, and other accessories of exploration will be placed in the Geographic Hall.

The Lindbergh exhibit in the Oceanic Hall was opened to the public on January 15, 1934. The plane has been suspended from the roof of the building in such a way that it appears to be flying over the surface of the sea in the vicinity of Andros Island, Bahamas, for, behind the plane and at the same level, one sees the huge seascape of the great Bahaman Coral Reef Group, which is now nearing completion on the lower floor of the building.

The twelve cases containing the equipment and accessories have been placed on the main floor of

the Oceanic Hall, beneath the point where the plane is suspended from the ceiling. The cases contain more than 400 items which have been arranged under the supervision of Vice-Director Roy Chapman Andrews and Curator Harold E. Anthony.

A casual examination of this Lindbergh material will convince one that the supplies and equipment which the modern explorer needs in exploring vast stretches of the earth's surface from the air, are quite different from that used by Columbus and those gallant men of the Sixteenth and Seventeenth centuries who succeeded in making the Americas known to the then ruling courts of Europe. To be sure, the Twelfth-Century compass and the sextant of 1730, those instruments which the early explorers used and which every ship captain and traveler needs for determining his course and his position in uncharted as well as charted regions of the earth, are in the Lindberghs' equipment. There are also chronometers and other modern instruments for reckoning and charting positions. Interesting features of the exhibit are the navigating board, the used and unused calculation sheets, a slide rule, lunar and air almanacs and a Weems line of position book. Modern maps, which are the

results of numerous explorations and surveys, are well represented in the Lindbergh collection; in fact, there are three cases full of them.

The accessory equipment includes clothes for arctic, temperate and tropical weather, a rifle, pistols, ammunition, a machete, a thirty-day emergency food supply, fish lines and nets in case of need, an eleven-foot sledge in three sections, a collapsible eight-foot rubber boat, a Primus stove, cooking utensils, blankets, black silk sheets, a tent, parachutes, landing flares, sea anchors, pumps, mosquito netting, goggles, waterproof matches, jackknife, and portable auxiliary radio equipment. This radio set is housed in a water-proof box and surrounded with rubber cushions so as to obviate shock. There is also a large miscellaneous assortment of engine equipment.

The plane itself is a Lockheed Sirius. It is 27 feet long and has a wing span of 43 feet. It is equipped with a 750-horsepower, 9-cylinder, Wright cyclone engine, which has been flown for only 250 hours out of a possible 4,000. It has a high speed of about 185 miles per hour. It is complete in every detail except for gas and oil. In the pilot's cockpit are the controls, stick and rudder, by means of which Colonel Lindbergh



IN THE PILOT'S COCKPIT OF "TINGMISSARTOQ"

Showing the complete array of instruments which enabled Colonel and Mrs. Lindbergh to stay on their course during their recent 30,000-mile survey. The plane, which is now on exhibit in the Hall of Ocean Life at the American Museum, is pictured in the frontispiece of this issue of *NATURAL HISTORY*

steered the plane. In front of the pilot's seat is the complete array of instruments which enabled the flying explorers to stay on their course. In the rear cockpit is the navigation and radio equipment used by Mrs. Lindbergh.

The plane was built in 1929 and acquired by the Lindberghs in 1930. Its first famous flight was from Los Angeles to New York, a distance of 2400 miles in 14 hours and 45 minutes and 32 seconds. Flights were also made in 1930 to Chicago, Washington, and Miami. In 1931 the Lindberghs used the plane in a flight to China by way of Canada, Alaska, and Japan, covering a distance of approximately 10,000 miles. Early in 1933 they made another flight from Los Angeles to New York. On July 9, 1933, the Lindberghs in coöperation with the Pan American Airways set out to make their Atlantic survey. Starting from New York, they made extensive explorations in Labrador and Greenland, toured Europe by air, and returned to the United States by way of the South Atlantic, crossing from Africa to Brazil, arriving in New York on December 19, 1933, after a journey of 30,000 miles.

Four large world maps showing the extent of the 1930, 1931, and 1933 flights of the Lindberghs have been placed in suitable positions about the Hall of Ocean Life. The transcontinental, Oriental, and Atlantic flights, when considered singly, were noteworthy undertakings; together, they constitute a remarkable log of modern exploration. To have flown some 50,000 miles in one plane, the "Tingmissartok," is almost beyond human comprehension. The record is a credit not only to the plane, the engineers who built it, but also to the pilot and the navigator who flew it, over land and sea, through all kinds of weather in temperate, arctic, and tropical climates.—CHESTER A. REEDS.

ASTRONOMY

A FINE EQUATORIAL TELESCOPE with eight-inch object glass has been presented to the American Museum by Mrs. Worcester Reed Warner as a memorial to her husband. This is the telescope which Mr. Warner used in his private observatory at Tarrytown, N. Y. It is a very fine instrument and was made by Warner and Swasey, who are the makers of the Lick, Yerkes, and Vancouver telescopes, each of which in its turn was the world's largest telescope. They are now engaged in making the big eighty-inch telescope for the University of Texas. The telescope presented so graciously by Mrs. Warner to the Museum is about the optimum size for New York skies. Mr. Warner was an honorary member of the Amateur Astronomers' Association and an enthusiastic

supporter of this society. This telescope which he used for so many years will be installed in a dome on one of the higher of the Museum buildings.

THE AMATEUR ASTRONOMERS' ASSOCIATION continues to hold its regular semi-monthly meetings as usual on the first and third Wednesdays of each month. Following is the schedule of lectures for March and April:

March 7—Dr. Charles P. Olivier, "Recent Developments in Meteoric Astronomy."

March 21—Dr. John A. Miller, "An Astronomer's Universe."

April 4—Dr. Charles H. Smiley, "Flying Mountains."

April 18—Captain J. F. Hellweg, "The New Forty-Inch Telescope at the United States Naval Observatory."

RADIO BROADCASTS.—Through the courtesy of Station WOR the Amateur Astronomers' Association has resumed its weekly astronomical talks over the radio. Tune in on Wednesdays, at 5:45 P.M., Station WOR.

CONSERVATION

THE keen interest of the United States in the conservation of natural resources for future generations, through the establishment of national parks and natural reserves of which Yellowstone, founded in 1872, was the first, has elicited the following tribute to America's foresightedness. Dr. Victor Van Straelen, director of the Royal Museum in Brussels, and first vice-president of the Commission du Parc National Albert, paid the tribute at Cody, Wyoming, August 21 last, during his recent visit to the States to attend the Sixteenth International Geological Congress.

I feel greatly honored by your invitation to address you tonight. In doing so I am tempted to call to mind one of the tasks with which I have been entrusted by my government, the organization and management of the National Parks and Natural Reserves in the Congo and in Belgium. And this leads me to call your attention to the fact that it is to the United States that credit is due for the foundation of the first natural reserve in the world: the Yellowstone National Park, created in 1872, whose name is familiar not only to all naturalists, but also to millions of other people. Its scientific exploration was started soon afterward, and in 1873 Holmes published his physiographical and geological sketches of the Yellowstone.

That region, the aspect of which so deeply impressed its first explorers, is as large as one fifth of my own country, Belgium.

Yellowstone was the first of a long series of parks and reserves in the U. S. A. and their number is increasing every year, owing to both public and private initiative.

You, my dear American friends, have been the first to enter on this path, and I may tell you frankly it is an extraordinary fact that a young nation like yours, still struggling against the antagonism of an unsubdued Nature, should already be thinking of preserving fragments of this Nature from the destructive interference of the human race, for the enjoyment and instruction of future generations. In this way you have given the world a proof of an idealism which you have often been quite falsely accused of lacking.

In my opinion the love of Nature is a quite recent acquisition of humanity. It increases in proportion to Man's ability to liberate himself from the grip of the inorganic as

well as from that of the organic world, from which he has evolved. Man has now become a geological factor, either directly through his work, or indirectly through his actions on the vegetable kingdom. His activities in the biological world surpass those of the most destructive organisms. No parasitic Protozoans are as destructive as man. He allows to live only that which is of immediate use or agreeable to his fancy. In looking at the evolution of mankind as we see it since the invention of mechanism, we may foresee a condition in which the whole biosphere would be reduced almost entirely to domesticated animals and cultivated plants.

You have been the first to appreciate this contingency before all other nations, and during many decades you have been alone with the Netherlands in erecting Nature reserves. All other civilized nations, as they become conscious of the necessity of maintaining untouched some portion of primitive Nature, now come to this very spot for an example and a stimulus.

Since 1905 King Leopold II invoked the American example to impress upon public opinion in Belgium the necessity of establishing reserves in the Congo. In 1929, through the personal initiative of King Albert, the Belgian government gave a legal status, under the chairmanship of the King's eldest son, to what is now the National Albert Park. Among the foreign members attached to the administration of this institution are two American citizens, Doctor Merriam and Professor Osborn, which proves the importance we attach to American advice.

Whilst I am mentioning these facts, some of you may perhaps be wondering what all this has to do with geology. Is not the progress of geological and palaeontological science largely dependent on the investigations rendered necessary by the appropriation of the Earth to Man's benefit?

Facies is one of the most familiar notions to geologists, and perhaps one of the most difficult to recall with precision. There is evidently only one method of defining the facies of the past: that is by comparison with that of the present, mainly by ecology and biogeography. But how would this be possible in the biological deserts which Man creates everywhere around him, even in his cultivated fields? Where will palaeontology find the necessary points of comparison if the whole of the existing floras and faunas, still so imperfectly known, remain entirely exposed to Man's accelerated and inexorable uprooting?

Much more might be raised on this point, but I think I have said enough to establish the high scientific and moral value of your initiative. In offering you the congratulations of my own country and of its sister institutions, I am also expressing the gratitude of all naturalists.

EDUCATION

BIRD WALKS.—On Tuesday, April 24th, Mrs. Gladys Gordon Fry, known to bird lovers and students as "The Bird Lady," will open her third season of spring bird-and-tree walks in Central Park, under the auspices of the American Museum of Natural History. The group will meet at six-thirty o'clock on Tuesday and Friday mornings in front of the main entrance to the Museum, on Seventy-seventh Street. The fee for the course of ten lessons will be \$12.

Applications may be made to the Department of Education, Room 306, in the School Service Building of the American Museum, or by telephoning ENdicott 2-8500, Extension 181.

THE TORREY BOTANICAL CLUB VISITS THE MUSEUM.—During the afternoon of November 11, an opportunity was afforded the Torrey Botanical Club to visit behind the scenes at the American Museum of Natural History. A party of eighty was conducted by Mr. S. Harmsted Chubb, associate curator in the department of comparative anatomy, through the laboratories of the departments of preparation, of osteology, and of marine life, and to the Akeley African Hall to see the work in process of construction

and to hear about the methods of preparation for the specimens and groups to be placed on exhibition.

In the osteological laboratory Mr. Chubb, explained his manner of procedure for expressing action and animal mechanics in mounted skeletons. He told of the methods of obtaining necessary photographic studies of animals in action, of the careful study during dissection of the specimen to be mounted, the cleaning and preparation of the bones, and then the reassembling of these bones in life-like pose to express a specific action.

THE LIBRARY

AS part of the Drummond Memorial Gift there have come to the Library of the American Museum some 200 volumes from the collections of the late Dr. Isaac Wyman Drummond. They comprise works on oriental carved ivory, jade, and amber, on sword guards and other arts and crafts of China and Japan, on near-eastern archaeology and travel. These magnificent treasures from a famous library have been presented by Doctor Drummond's sister, Mrs. William Herbert, whose generosity has been the means of greatly enriching the Museum's resources on these important subjects.

DURING September, October, November, and December, the following *Novitates* and *Bulletins* were published by the American Museum:

NOVITATES

- No. 654. Mounted Skeleton of *Triceratops Elatus*. By Henry Fairfield Osborn.
- No. 655. New American *Dolichopidae*. By M. C. Van Duzee.
- No. 656. New Fishes from the Kasai District of the Belgian Congo. By J. T. Nichols and F. R. LaMonte.
- No. 657. A New Species of Shrew from Eastern Siberia. By George G. Goodwin.
- No. 658. Pennsylvanian Foraminifera from Mongolia. By J. J. Galloway and L. Erskine Spock.
- No. 659. The Distribution of Rotifers on Mount Desert Island. Part II. New Notommatidae of the Genera *Notommata* and *Proales*. By Frank J. Myers.
- No. 660. The Distribution of Rotifera on Mount Desert Island. Part III. New Notommatidae of the Genera *Plurotrocha*, *Lindia*, *Eothina*, *Proalinopsis*, and *Encentrum*. By Frank J. Myers.
- No. 661. Taxonomic History of the Neotropical Hares of the Genus *Sylvilagus*, Subgenus *Tapeti*. By G. H. H. Tate.
- No. 662. Four New Species of Decapod Crustaceans from Porto Rico. By Waldo L. Schmitt.
- No. 663. A Fossil Skunk from Samos. By Guy E. Pilgrim.
- No. 664. Dragonflies from Mt. Duida and the Venezuelan Border. By James G. Needham.
- No. 665. Birds Collected During the Whitney South Sea Expedition. XXVI. Notes on *Neolalage Banksiana* (Gray). By Ernest Mayr.
- No. 666. Birds Collected During the Whitney South Sea Expedition. XXVII. Notes on the Variation of Immature and Adult Plumages in Birds and a Physiological Explanation of Abnormal Plumages. By Ernst Mayr.
- No. 667. A Nevada Fauna of Pleistocene Type and its Probable Association with Man. By George Gaylord Simpson.

- No. 668. Studies of Peruvian Birds. XI. The Genera *Taraba* and *Sakesphorus*. By John T. Zimmer.
 No. 669. A New Longhorned Belly River Ceratopsian. By Barnum Brown.
 No. 670. A Skull with Jaws of *Crocodylus Sivalensis* Lydekker. By Charles C. Mook.
 No. 671. A Crocodilian Skeleton from the Morrison Formation at Canyon City, Colorado. By Charles C. Mook.
 No. 672. Three Obscure Genera of Ponerine Ants. By William Morton Wheeler.
 No. 673. New North American Diptera. By C. H. Curran.
 No. 674. A New Flying Squirrel of the Genus *Petaurista* from Northwestern Siam. By T. Donald Carter.
 No. 675. The African Species of *Curtonotum* Macquart (Drosophilidae; Diptera). By C. H. Curran.
 No. 676. The North American Species of *Anorostoma* Loew (Helomyzidae; Diptera). By C. H. Curran.
 No. 677. The Spermaceti Organ and Nasal Passages of the Sperm Whale (*Physeter Catodon*) and other Odontocetes. By H. C. Raven and William K. Gregory.
 No. 678. A Skull of *Crocodylus Clavis* Cope, in the United States National Museum. By Charles C. Mook.
 No. 679. Two New Dinosaurian Reptiles from Mongolia with Notes on some Fragmentary Specimens. By Charles W. Gilmore.
 No. 680. The Status of *Minerva Antiqua*, *Aquila Ferox* and *Aquila Lydekkeri* as Fossil Birds. By Alexander Wetmore.
 No. 681. Mammals Collected in the Maritime Province of Siberia by the Morden-Graves North Asiatic Expedition, with the Description of a New Hare from the Amur River. By G. G. Goodwin.
 No. 683. Some North American Diptera. By C. H. Curran.

BULLETIN

- Volume LXVI, Article 2. The Sarcophaginae of Panama (Diptera: Calliphoridae). By David G. Hall.
 Volume LXVII, Article 2. On the Dinosaurian Fauna of the Iren Dabasu Formation. By Charles W. Gilmore.
 Volume LXVII, Article 3. Glossary and Correlation Charts of North American Tertiary Mammal-Bearing Formations. By George Gaylord Simpson.

FISHES

THREE fishes sent to the American Museum from Indo-China, by Mr. Arthur Vernay, belong to a genus believed by native fishermen to have some mysterious connection with the teeth of the crocodile. Some natives believe the fish to be a tooth which has left the crocodile's mouth and taken on a life of its own; others regard it as a rejected crocodile toothpick!

The native name, "Kunnur dant," means crocodile's teeth. Of course it is easy to dismiss such an idea as preposterous, but since there must be some connection or association between fish and crocodile, at least in the minds of the fishermen, it would be interesting to investigate further. Was this name originally given merely on account of the crocodile-like scutes of the fish, the elongated snout and prominent, ringed eyes, or does the fish hang around the open-mouthed crocodile, hoping to pick up tiny fragments of its last meal? Perhaps some Indian naturalist might be in a position to clear up this mystery.

"Kunnur dant" undoubtedly includes several different species, and possibly more than one genus. The fishes shown in the accompanying photograph have unfortunately lost their small tails in transit, but appear, without doubt, to be a species of *Doryichthys* (formerly called *Microphis*).

Although they themselves are unpleasant-looking objects, they are closely related to the popular little sea horse. Unlike it, they do not swim in a vertical position, although they are apt to drift around in a slanting attitude.

In most of the fishes of this order, the male hatches the eggs, which are deposited in a pouch on his breast and remain there until the young emerge.

The family is inadequately covered in the literature, although the fishes are particularly interesting for several reasons. Apparently there are either a great number of species in this genus, or great variety within one species, and certainly there is a wide difference of appearance between young and old of the same fish. Although primarily marine in distribution, *Doryichthys* is found quite far up rivers. It is abundant where found, but very localized, and therefore comparatively rare in collections. These



"KUNNUR DANT"

Two of the three fishes from Indo-China acquired by the American Museum through the courtesy of Arthur S. Vernay. Native fishermen believe they have some mysterious connection with the teeth of the crocodile

three are the only representatives of the genus in the collections of the American Museum.

—F. LAMONTE.

INSECTS

CURATOR LUTZ and Associate Curator Mutchler attended the meetings of the national scientific societies at Boston during Christmas week. Doctor Lutz gave the annual address at the joint meeting of the Entomological Society of America and the Association of Economic Entomologists. The next week he spoke on museum work at the University of Toronto and on "Testing Insect 'Intelligence'" at the Royal Canadian Institute.

THE degree of Doctor of Science has been awarded to Assistant Curator C. H. Curran by the University of Montreal, in recognition of his splendid work on flies, including his as yet unpublished revision of and keys to North American genera.

MAMMALS

THE BEROLZHEIMER GIFT OF MAMMALS.—The American Museum has just recently received a small but interesting collection of mammal specimens, the gift of Mr. Alfred C. Berolzheimer of New York City, a member of the American Museum who, with Mr. James L. Clark, made a hunting trip to the headwaters of the Yellowstone River, Wyoming, during the month of September.

Mr. Berolzheimer's interest in the Museum influenced him to vary his plans from the usual sportsman's pattern, and to this end he requested Mr. Clark to preserve complete specimens which might be donated to the Museum rather than to consider them as the sportsman's trophy of head and horns.

The most noteworthy specimens are a very fine male and female Shiras moose represented by skins and complete skeletons. This race is scientifically interesting because it has the southernmost range of all of the moose and may be considered as being derived from Canadian animals which worked south along the slopes of the Rockies.

There are also two large bull elk as skins and complete skeletons, and two exceptionally fine pronghorn antelope, the latter taken in the plains country around Gray Bull River where there is today a herd of about 3000.

In addition to the collection of specimens, many still photographs of the habitats of these animals were taken and will be very useful in developing the habitat groups for the new Hall of North American Mammals. About 2500 feet of motion pictures were obtained, the outstand-

ing feature of which is many feet of close-up pictures of the Shiras moose which may be used in connection with the educational work of the Museum.

COMPARATIVE ANATOMY

THE Cope-Osborn Theory of Trituberculy, as it is known among paleontologists, celebrated its half-century of existence at a meeting of the American Philosophical Society on January fifth, upon which occasion Dr. William K. Gregory gave an illustrated lecture on this subject. The Society will devote a special number of its Proceedings to this paper.

SCIENCE OF MAN

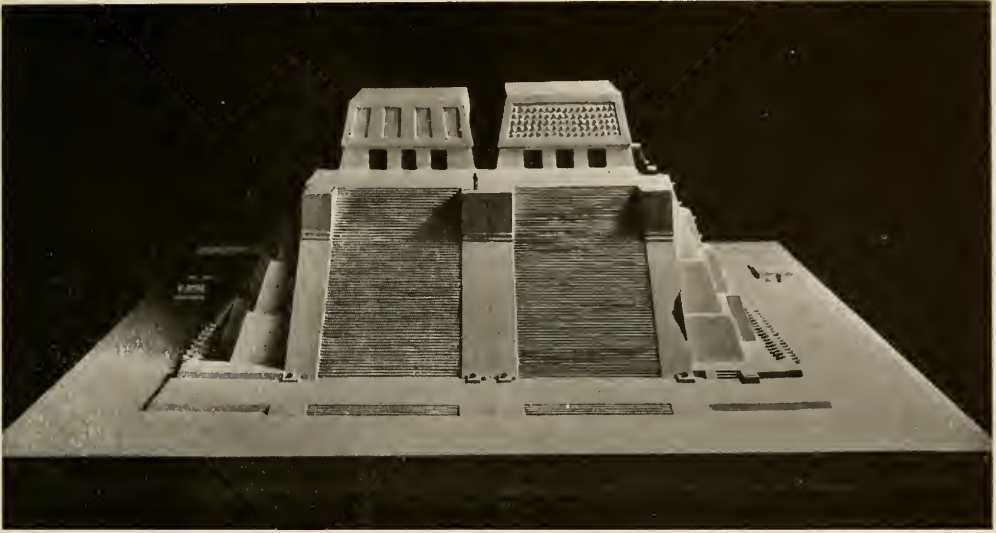
DOCTOR MEAD'S NEW GUINEA COLLECTIONS.—Debating stools, temple ornaments, human heads, ceremonial masks, and elaborate headdresses are among the features of an outstanding collection recently brought to this country from New Guinea by Dr. Margaret Mead. It has been placed on view in the Philippine Hall of the American Museum of Natural History.

The specimens brought back by Doctor Mead form not only a valuable addition to the ethnological collections of the American Museum but also represent an important contribution toward scientific knowledge of the lives and customs of primitive peoples.

Doctor Mead, who is assistant curator of ethnology, last fall returned from New Guinea, where she worked for two years among the Arapesh of the Prince Alexander Mountains, the Mundugumor Tribe on the Yuat River, and the Tchambuli Tribe on the Aibom Lake. Both of the last-named tribes are situated on the Sepik River, of which the Yuat is a tributary and the Aibom Lake an extension. *NATURAL HISTORY MAGAZINE* is expecting to publish in a later issue an interesting account of some of Doctor Mead's experiences.

ASOUTH SEA HEADRESS.—An interesting addition to the South Sea Hall at the American Museum is a Port Moresby dance headdress. It was collected and donated to the Museum by Mrs. Jo Mielziner.

AMODEL OF THE AZTEC TEMPLE at Tenayuca, Federal District, Mexico, has just been put on view in the Mexican Hall of the American Museum. The Spanish Conquest of Mexico in 1519-20 was so complete that few examples are left of Aztec architecture, and this model is probably the first that has ever been constructed to illustrate the architecture of this civilization.



MODEL OF THE PYRAMID AT TENAYUCA, FEDERAL DISTRICT, MEXICO

Now on exhibition in the Mexican Hall of the American Museum. Note the imposing mass of the structure as compared to the figure at the head of the stair

The original temple epitomizes the history of the Valley of Mexico. According to tradition, after the Tenth Century, a tribe of fierce nomads, the Chichimecs, filtered into the Valley and brought about the downfall of its civilized occupants, the Toltecs. The Chichimecs took over elements of the Toltec culture and began a sedentary life. Later, other tribes like the Tepanecs and the Acolhuas entered the Valley and, fusing with the Chichimecs, built up a civilization. Finally came the Aztecs, who, absorbing this Chichimec-Acolhua culture, became strong enough to dominate the Valley tribes.

At Tenayuca six temples were found superimposed, the upper two of typical Aztec architecture. Excavations near by revealed three layers of pottery, the upper of Aztec date, the second probably to be correlated with the Tepanec-Acolhua people, and the crude styles of the lowest layer assignable perhaps to the Chichimec. While it was not possible specifically to correlate the ceramic styles with the individual buildings, yet it is very probable, to judge from the changes in the profiles of the buildings, that they were made by these successive peoples.

The symbolism of the temple involves the worship of the natural forces governing agriculture. Enough stone ornaments were found to reveal the presence of two temples, one honoring the goddess of the Earth and the other the god of War, who was also connected with the Sun. The serpents ornamenting the sides symbolize

the earth, and the two connected with the altars flanking the pyramid represent the 52-year calendric cycle which the Aztecs considered much as we do our century.

The excavations were carried out by the Department of Prehistoric Monuments of the Mexican Government during the years 1925-32 as part of their program of reconstruction and research on their antiquities. In making this model Mr. Shoichi Ichikawa, of the division of anthropology, followed the plans of Mr. Igancio Marquina, head of the department, under the supervision of Mr. Hay and Doctor Vaillant. It is a privilege to present to American Museum visitors this tangible example of the coöperation between the archaeologists of Mexico and the United States. Unfortunately this model was completed too late to include its picture in "The Architecture of Central America," the first of the series of articles on the Arts of Central America, appearing in this issue of *NATURAL HISTORY*.

—G. C. V.

REPTILES AND AMPHIBIANS

AT the annual meeting of the American Association for the Advancement of Science held at Cambridge, Massachusetts, Dr. G. K. Noble presented before Section F two demonstrations on the tactile organs of reptiles. These structures are of particular interest because they have special functions in the social life of reptiles. The mammalian hair seems to have evolved from one type of reptile tactile organ and the particular

functions of the several different types had not been previously known. The facial pit of the rattlesnake represents a type of tactile organ which has become specialized for the detection of air vibrations.

Doctor Noble and Doctor Clausen presented a paper before the American Society of Ecologists on the aggregation responses of serpents. Heretofore it was not known that outside the breeding season some snakes follow the trails made by other individuals of their own species. In times of desiccation some snakes come together in aggregations to conserve the water which might be lost by evaporation. Clustering also lowers the respiratory rate, thus further conserving the energies of the species.

A BENEFACITOR OF THE TROPICS.—In many parts of the American tropics one of the most characteristic creatures which the visitor to that region sees in the evening is a large toad known to taxonomists as *Bufo marinus*. Although many naturalists may have suspected that this toad might be of great value in maintaining the balance of nature, only recently has detailed information been secured. In a recent number of the Journal of Economic Entomology, Dr. M. D. Leonard gives a report of the stomach contents of a series of these toads secured in Porto Rico. He finds that 51% of the stomach contents constituted insects injurious to agriculture, 42% neutral species, while only 7% might be considered beneficial forms. It was found that the toad was capable of eating in one night 12.5 June beetles, a species injurious to bananas and other plants. In 1913-1914 one plantation in Porto Rico spent \$1876.73 for the hand collection of 1,662,000 beetles over a period of 133 days. At the rate of 12.5 per night, 1000 toads could

handle the same number of beetles in the same time at no cost at all.—G. K. N.

HARRY WATKINS

THE sad news comes from Lima, Peru, that Harry Watkins, long associated with the South American field work of the American Museum's department of birds, died at his home in Lima, on July 5, 1933, after some months' illness with tuberculosis. His wife, who accompanied him on many of his excursions, survives him in Lima.

Harry Watkins, the son of an English entomologist, first went to Peru in 1902 to collect butterflies. During the following thirteen years, he varied his activities in this field by engaging in mining and other developmental projects, and



A GIANT TOAD FROM THE TROPICS

This toad is a voracious insect eater, saving West Indian planters thousands of dollars each year

began his bird collecting in 1911 for Mr. W. F. H. Rosenberg of London. His association with the American Museum began in 1915 and continued until 1926. During this time he explored many parts of Peru and sent in more than 12,000 bird skins, including many forms new to science, several of which have been named in his honor. He was an expert photographer and, after leaving the service of the American Museum, engaged in that occupation, especially in aerial survey work for the Peruvian Government and for the Standard Oil interests in Bolivia and Venezuela.

Mr. Watkins' excellent specimens and the photographs and field-notes which accompanied them form a lasting monument to his industry and efficiency. These specimens form the backbone of the American Museum's collection of Peruvian birds now being studied in the preparation of the volume on the distribution of bird-life in Peru, the third work in the series of Andean bird-life studies begun in 1910, of which the volumes on Colombia and Ecuador have already appeared.—J. T. ZIMMER.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

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Mrs. KATHERINE W. D. HERBERT.

Honorary Life Members

Miss MILDRED CONNER.

Mr. ALFRED C. BEROLZHEIMER.

Sustaining Members

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Messrs. WOOLWORTH DONAHUE, E. TOWNSEND IRVIN.

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Misses ALLISON GARVER, ANNAH HAZEN, HELEN R. HEND-

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NEW PUBLICATIONS

Man and the Vertebrates. By Alfred Sherwood Romer, Professor of Vertebrate Paleontology in the University of Chicago. The University of Chicago Press, vii+427 pages, 278 text figures.

SO many good things are to be said about this book that it is hard to know where to begin. Its readability is such that even without the large number of excellent figures its text gives a clear though condensed account of the vast epic of evolution. Up from the lowest known pre-fishes of about four hundred million years ago, it follows the wandering trail, showing where the numerous by-paths branch off toward the dinosaurs, birds, and other specialized groups, but always coming back to the main road leading to man. Not stopping there, however, the story follows the branching of mankind and then describes the amazing transformation from egg to old age. The reader who enjoys the author's

descriptions of the numerous groups of fishes, reptiles, birds, and mammals, can hardly fail to realize the importance of visualizing these other branches in any attempt to reach a philosophical judgment as to what man is and where he came from. Thus this modestly-sized book is practically an outline of vertebrate palaeontology and a visual epitome of the major classification of all the vertebrates; it gives the embryological key to the intricate adult anatomy of the circulatory, digestive, and nervous systems, together with the evolutionary key to the history of the skull and locomotor system.

Fortunately the author has not wasted his space in argumentation over the general evidence for evolution nor felt it necessary to defend the right of *Homo sapiens* to be recognized as a member of the order of Primates. Nor in the

brief space available has it been possible to set forth the evidence for many a far-reaching conclusion as to the origin and rise of the vertebrates. The present volume may indeed be regarded as a semi-popular sequel to Professor Romer's *Vertebrate Paleontology*, where the reader will find many fair and critical appraisals of the evidence together with the factual basis for our modern concept of the tree of life.—W. K. G.

Tropical Fishes as Pets. By Christopher Coates. Photographs by S. C. Dunton. 226 pp., New York: Liveright.

THE widespread hobby of collecting and breeding tropical fishes in private homes has created not only a large and profitable industry, especially here and in Germany, but an enormous demand for expert information and guidance.

Mr. Coates, who is in charge of the New York Aquarium's splendid collection of tropicals, and who conducts a weekly column on this subject in the New York *Sun*, gives us a compact book, written in an easy, non-technical style, and well adapted to the needs of both expert and amateur. There is practical instruction about assembling an aquarium, beginning with the collection and transportation of the fishes—those small creatures so strangely susceptible to seasickness! Sizes and styles of tank are discussed, as well as temperature, light, plants, chemical balance of water, and, finally, choice of inmates for the tank—all in a way that takes into consideration the owner of the smallest goldfish bowl as well as the largest commercial supply house.

There is a valuable chapter on food and feeding, and one on the treatment of disease, and, more important, its prevention.

All through the book one finds interesting and amusing bits of information about collection, prices, or the distant places of the fishes' origin, many of which the author has known well.

The book does not purport to be a complete list of tropical aquarium fishes. It discusses the possibilities and care of such fishes, divides them into the larger groups, and takes up numerous examples under each group. This section includes much first-hand data on the habits of the fishes—their courtship, breeding, nesting, and parental care; their preferences in food, and their temperaments.

Some fishes are peaceful and suitable for community life, while others are pugnacious or even cannibalistic, making them unsuitable. Still others display infanticidal tendencies and their young must be removed from reach of their jaws. Many have strange breeding habits. *Copeina arnoldi*, for instance, hops up out of the water several inches and deposits its eggs on a rock or

leaf, after which it spends the next two days laboriously splashing water up on to the eggs with its fins. Some of the Cichilidae make holes in which they deposit their eggs, then pick them up and store them in the parent's mouth until they hatch. Among certain genera of this same family, parental care is developed to a surprising extent. Sometimes a pair of fishes takes turns at guarding its young, one swimming off as the other comes to relieve it.

There are fishes whose color rivals the brightest rainbow; fishes of the deepest blues and reds, and the densest black, and fishes of gleaming silver. And there are the lowly, undecorative scavenger fishes, not beautiful, but most useful in the tank.

The fifty-six illustrations were taken in the Aquarium, and are most unusual and beautiful. The book is informative and practical, and makes very entertaining reading.—F. LAMONTE.

THE recent appearance of *The American Field Naturalist*, monthly mimeographed magazine of the American Naturalists' Association, edited by William G. Hassler, calls to mind a number of closely related publications of the past and present. The thirteen-page November issue is well planned and well written. The field notes, edited by Mr. John C. Orth, are particularly valuable as records.

The mimeographed medium becomes an increasingly useful field for those who seek concrete self expression upon the printed page. In 1925, and for three years thereafter, a very similar magazine was issued by the camps in the Palisade Interstate Park. This pioneer project was known as *The Camp Naturalist*. At one time it reached a list of 4,230 subscribers. Since then, various local natural history clubs in schools, Boy and Girl Scout Groups, and others, have developed their own journals.

Outstanding among these periodicals are the ones released by the naturalist staffs of the National Parks under the supervision of the Department of the Interior. The *Yosemite Nature Notes*, an excellent publication of field observations, is perhaps the first in the National Park group. It has now adopted a printed form. The *Nature Notes from Acadia*, presented by the Acadia National Park, at Bar Harbor, Maine, is a comparatively new member of the list. Arthur Stupka writes charmingly for this magazine.

The *Junior Astronomy News*, issued at the American Museum, is an excellent magazine that must be included in any list of American natural history mimeographed material.

The *American Field Naturalist* enters the field with an attractive product and an ambitious title. We wish it all success.—W. H. C.

Tropical Fishes as Pets

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BY WILLIAM H. CARR

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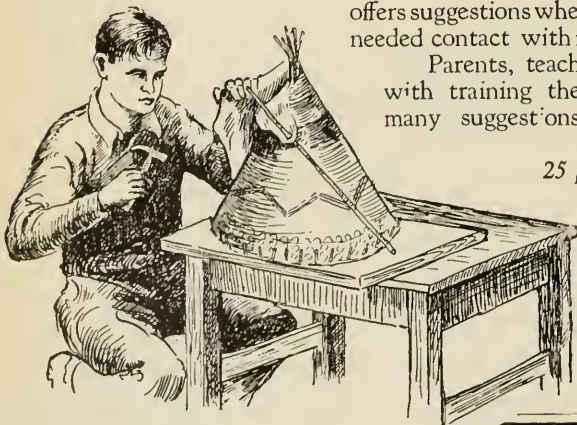
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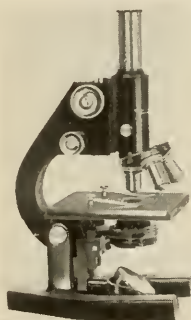
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NUMBER 3

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MAY-JUNE
1934

The Journal of The American Museum of Natural History

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BLAZING THE TRAIL

IT is hard to think of a way in which one can approach Nature more closely than by going camping. The trees and streams, the rocks and soil, the mammals, birds, and fish seem to the camper very definitely a part of the world in which he is temporarily sojourning, as indeed they are. And there is no better way to renew one's youth and enthusiasm than thus to drop one's contacts with a too complex existence. Fortunately, we of North America have innumerable opportunities to camp, whether modestly for a week-end, or ambitiously during a veritable expedition into the wilds. Dr. Frank Oastler, whose camping experience is enormously broad, has written an article for the next number of *NATURAL HISTORY* which has already made us long for the trail, the mountains, and the woods. We fully expect that it will do the same for our readers.

THIS matter of sea serpents is something we can no longer ignore. As the official publication of a great scientific institution *NATURAL HISTORY* has been very superior about these yarns, and has refused to dignify them by even so much as a remark. But there are too many questions and far too many new accounts for us to continue our original course. Consequently we have asked Dr. William King Gregory, curator of comparative anatomy at the American Museum, to write an article on the subject. It will appear in the next number.

SOME strange stories have recently come from Chinese Turkestan. In the first place, certain citizens of that distant land seem to have become just a bit fed up with their association with China, and have decided to go it alone. That in itself is interesting, but when, having decided that they needed a king to head their new national government, they selected an English pickle manufacturer who had dwelt among them for a time, it

began to sound very much like Gilbert and Sullivan, and we wish the matter could have ended there. The next step, however, was tragic enough, for the opposition brought on a battle that resulted in thousands of casualties.

Few of us know much of Chinese Turkestan, and fewer still have visited it. But for the next number of *NATURAL HISTORY*, Mr. James L.

Clark, vice-director of the American Museum, will describe what he knows of the land from his journey to its mountains, cities, and deserts.

THE next number of *NATURAL HISTORY* will appear on the first of July, when many of its readers will be along the seashore, and if they do as we have often found ourselves doing, they will periodically pick up some shell, some strange creature of the shallows, or some bit of marine vegetation, and say quite solemnly, "I wonder what that is?"

In an attempt to answer some of the questions that arise in this manner,

Dr. Roy Waldo Miner, curator of lower invertebrates at the American Museum, has written an article for the next number of *NATURAL HISTORY* in which he discusses the life of the tide pools and the beaches.

THIS page is far too small when we allow our enthusiasm full sway over the material we are to publish. It is impossible for us to hold ourselves down to the limits of space. There are several other articles for our next number, each of which deserves a large paragraph of its own. But space is at a premium, and we can barely mention them. There is, for instance, an article by Dr. Robert T. Hatt on pangolins and aard-varks, strange appearing creatures of Africa that feed on ants. Dr. Margaret Mead has written a second article about her experiences with the natives of New Guinea, and Dr. George C. Vaillant has written a third article on the art of Central America.

THE COVER PAINTING

A CORNER of an aquatic garden is depicted in the cover painting of this issue of *NATURAL HISTORY*, by Francis L. Jaques, staff artist of the American Museum. In the article "Water Plants for Home Cultivation" appearing in this issue, many types of water plants are discussed. The yellow pond lily, *Nymphaea advena*, shown on the cover, is one of these, and is the only true water lily called by botanists a pond lily. It has a strikingly beautiful flower, and grows wild throughout eastern North America.

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NATURAL HISTORY

MAY-JUNE
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The Journal of the American Museum of Natural History

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THE FEATHERED SERPENT

Detail from relief at the temple of Quetzalcoatl, Teotihuacan, Mexico. Teotihuacan is the site of the first real civilization in the Valley of Mexico. After Lehmann, 1933

(See "The Sculpture of Pre-Columbian Central America," Page 259)

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WATER PLANTS FOR HOME CULTIVATION

Old and New Plants for Use in Home Aquaria and Garden Pools

By E. J. ALEXANDER

Assistant Curator, New York Botanical Garden

GREAT interest has recently been aroused in aquatic plants that may be easily grown in home aquaria and pool gardens. At present the New York Botanical Garden has on view in its museum building about sixty kinds suitable for home aquaria. There is also a permanent showing in Conservatory Range 1 of some of the most attractive of cultivated aquatic and swamp plants.

Besides these already fairly well-known species, others are described here because of their undoubted value for aquaria and pools, could they be introduced. It is hoped, in fact, thus to arouse interest in their collection and subsequent cultivation.

Aquatic plants, though many belong to the same families as terrestrials, are found to have definite peculiarities of structure. As a general rule they are simpler than land plants.

In true aquatics (submerged plants) there are but few types of leaves: broad-elliptic or oblong, long and straplike, or short and extremely narrow, or divided into a number of fine threads. These leaves, as well as the stems, have very

little cuticle, or hard, protecting surface, so that water containing the dissolved salts and gases needed by the plant for food passes in easily. There are no air-pores, and but few wood-vessels, and such roots as are present are not for absorbing food, but merely to fasten the plant to the bottom; there are very few if any root-hairs. These plants grow rapidly, often branch freely, and reproduce mostly by vegetative means instead of by seed; often they do not flower freely. In a few cases, flowers are fitted for pollination under water, the water acting as a pollen-carrying medium, and some are adapted for pollination at the surface. In most, however, the floral parts are borne above the water where pollination is effected as in land plants, either by wind or by insects.

On the vast majority of floating leaves the entire undersurface is transformed into a thick, spongy, but fleshy tissue. Leaf-stalks or stems which are inflated have the same structure, as an aid in keeping them afloat. These floating leaves otherwise have the same general structure as those of land plants, but they bear air-pores (stomata) on the upper



Photograph by courtesy of
J. K. Small

WATER-HYACINTH

Eichornia crassipes is a native of tropical South America. In Florida where this plant has become a pest, it is known as "lilac-devil"

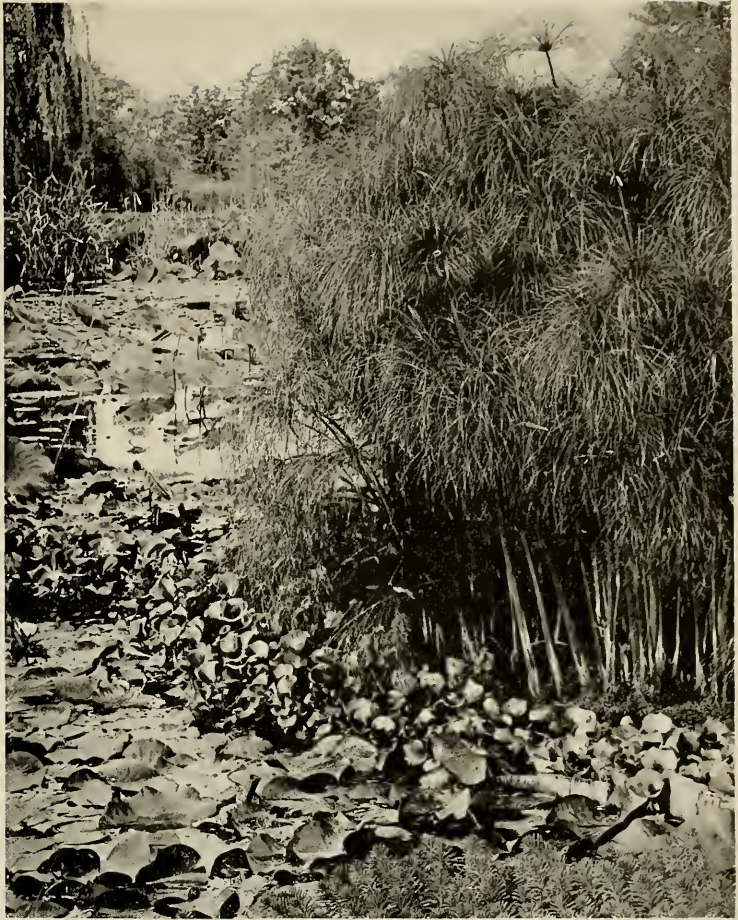


WATER-POPPY

Hydrocleis nymphoides, native of tropical America, is a handsome subject for planting out in summer in ponds or pools, where its large, yellow flowers make a fine display

AT THE EDGE OF A
POND

At the right is a planting of papyrus. In the left rear are lotuses, and in the foreground, water-hyacinths, parrot's-feather, and water lilies



WATER LILY

The best known and most beautiful of aquatics can, because of the variation in size among different species, be grown in a large aquarium, a tub, or small pool, as well as in large tanks and ponds





Ottelia alismoides, A SPECTACULAR AQUATIC OF THE OLD-WORLD TROPICS IS A COMPLETELY SUBMERGED PLANT, THE FLOWER BORNE JUST ON THE SURFACE OF THE WATER. AT PRESENT IT IS UNKNOWN IN AMERICAN GARDENS. ADAPTED FROM KOMAROV, *Key for the Plants of the Far Eastern Region of the USSR*

surface, which is covered with cuticle or wax to prevent wetting.

While water plants represent only a small percentage of seed-bearing plants, they are widely scattered through the plant kingdom. The greater number, however, are found among the more simply organized plant groups.

At the bottom of the class of flowering plants is the large order of Naiads, con-

taining nearly all of the truly aquatic members of the division of monocotyledons. In this group are the two similar appearing genera, *Zannichellia*, the horned-pondweeds, and *Ruppia*, the ditch-grasses, both consisting of tangled masses of threadlike stems and leaves. The pondweeds, genus *Potamogeton*, are attractive plants in nature with elliptic or short, straplike leaves, beautifully veined, underwater, or in some species narrow, grasslike leaves. Some, as they approach the flowering stage, develop elliptic, floating leaves. Only a few of them, however, are satisfactory under cultivation.

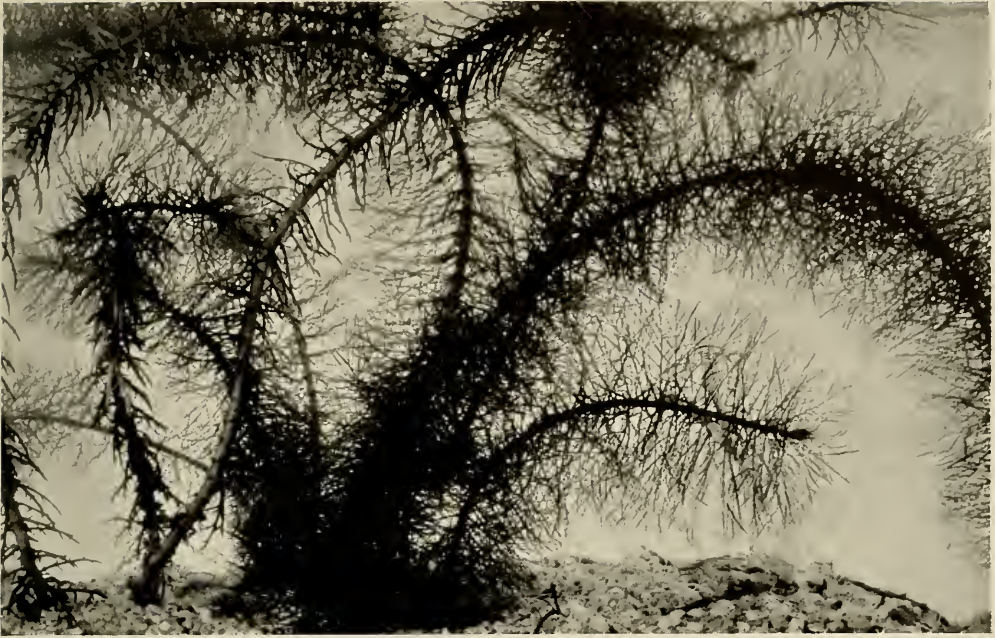
The genus *Najas* contains a number of species, mostly slender-stemmed and much-branched, with short, slender, bright green leaves, usually toothed.

Still among the Naiads, the genus *Aponogeton*, the water-hawthorns, have underwater leaves which are long and



WATER-MOSS

A plant of cold waters is *Fontinalis antipyretica* of the north temperate zone. To do well in aquaria, this must have cool water, as heat kills it



ONE OF THE FINEST OF THE MILFOILS

Myriophyllum pinnatum is bright green in color. Note the two types of leaf. The less dissected ones are on shoots which were aerial, but, upon being submerged, the more divided underwater form developed

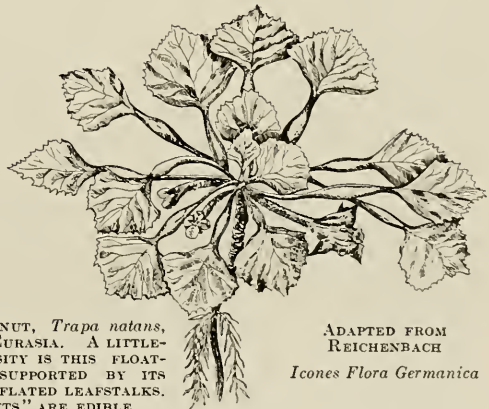
ribbon-like, tongue-shaped, or elliptic, with elliptic floating leaves and forked spikes of fragrant flowers. The lace-plant of Madagascar, with large, broadly elliptic leaves consisting solely of a lace-like, open network, is one of the members of this genus, though it is sometimes separated out under the name of *Ouvirandra*.

The water-plantains, *Alisma*, and the arrowheads, *Sagittaria*, both familiar plants around New York, as well as a number of related genera, are also much used. They mostly have straplike underwater leaves, and elliptic or arrow-shaped ones above water. A few species have floating leaves and one has tubular-shaped ones. They all have white, pink, or yellowish flowers.

The so-called flowering rushes are most attractively represented by the water-poppy, *Hydrocleis nymphoides*, whose floating stems bear heart-shaped leaves. Its

flowers look like large three-petaled yellow poppies afloat on the surface. The flowering rush itself is a large, handsome, hardy plant, well suited to outdoor use.

The frog-bits have a number of representatives among which are two of the most important aquarium plants, wild celery and water-weed. The wild celery or eel-grass, *Vallisneria*, is recognized by its long ribbon-like leaves and spirally



THE WATER-NUT, *Trapa natans*, NATIVE OF EURASIA. A LITTLE-USED CURIOSITY IS THIS FLOATING PLANT SUPPORTED BY ITS BLADDERY-INFLATED LEAFSTALKS. THE "NUTS" ARE EDIBLE

ADAPTED FROM
REICHENBACH
Icones Flora Germanica



TWO GRACEFUL AQUATIC PLANTS

The plant at the left is the fanwort, *Cabomba caroliniana*, a close relative of the water lily, native of the southeastern United States. *Sphagnum macrophyllum*, a recently introduced moss, is on the right.

The sphagnum has lost its green color and is transparent with a brownish cast



coiled stalks, which carry the female flowers to the surface and withdraw them again after pollination. *Anacharis*, the waterweed, has the short, narrow leaves borne in close whorls along the stem.

The true frog-bit is a floating plant with heart-shaped leaves and three-petaled white flowers. The related water-soldier or water-aloe, a Euro-

pean plant worth bringing to America, has aloe-like leaves with spiny margins, and white, three-petaled flowers. This plant sinks to the bottom in winter when the leaves become incrustated with lime from the water, and rises to the surface in the spring, because of the relative lightness of the young leaves. The two genera *Boottia* and *Ottelia* are other foreign members of this family which are also very deserving of cultivation. *Boottia* has long, beautifully veined leaves underwater, and heart-shaped ones above, sometimes growing two or three feet high, while *Ottelia* has leaves varied in shape, which often reach a foot in length in running water. So much for the greater majority of monocotyledonous aquatics.

Among the higher Monocotyledons in the Order of Poales, the grasses and sedges, are some swamp plants already in cultivation as aquatics. The only truly aquatic grass is the Asiatic genus *Hygrophorhiza*, with broad, lance-shaped leaves

FOR HARDY POND PLANTINGS IS THIS FLOWERING RUSH, *Butomus Umbellatus*, NATIVE OF EUROPE. IT IS NOT KNOWN IN THE UNITED STATES, BUT HAS ESCAPED FROM CULTIVATION ALONG THE ST. LAWRENCE RIVER IN CANADA. THE LEAVES ARE FROM TWO TO THREE FEET LONG, AND THE ROSE-COLORED FLOWERS AN INCH ACROSS. ADAPTED FROM SCHNIZLEIN, *Iconographia Familiarum Naturalium Regni Vegetalis*

floating on the surface, dangling feathery roots in the water. Species of *Scirpus* and *Eleocharis* of the sedges are both used under the name of hair-grass. When kept under water, they consist only of masses of threadlike, branched stems. *Websteria submersa*, a recently introduced sedge, bears its threadlike leaves in dense clusters. The papyrus-plant, *Cyperus papyrus*, though very large, is valuable for outdoor pools. The so-called umbrella palm, *Cyperus alternifolius*, with a number of grasslike leaves borne umbrella-like at the top of the long stem, is also rather popular.

In the family of the arums and calla lilies are some of the most decorative of aquatic plants. The best, because readily available and easily grown, is *Cryptocoryne*, two types of which are used, one with long, narrow, tongue-like leaves, and one with elliptic leaves sometimes heart-shaped at the base. How many species are involved is doubtful, as flowers, which are necessary for satisfactory identifica-

A NATIVE SPECIES OF ARROWHEAD NOT AT PRESENT USED IN AQUARIA, BUT WELL WORTHY, IS *Sagittaria teres*, WITH ROUND-TUBULAR LEAVES, COMPLETELY SUBMERGED; THE FLOWER STALK RISING A FEW INCHES ABOVE WATER



tion, are rare. *Pistia*, the water-lettuce or shell-plant, with velvety, pale green leaves, is an attractive floating plant. The arrow-arum or green arum, *Peltandra virginica*, is a member of this family, though often sold as narrow-leaved spatterdock, which is a water lily, and about as much related as is a squirrel to a fish. *Peltandra* is not a true aquatic, and hence is short-lived under such conditions. The golden-club, genus *Orontium*, while too large for an aquarium, is fine for outdoor pools where its large blue-green leaves and club-shaped spikes of yellow flowers are quite showy.

A number of members of the duckweed



THREE EXCELLENT AQUARIUM PLANTS

On the left is *Najas flexilis*, a fragile plant, not much in use at present; in the center, one of the bladderworts, *Utricularia*; on the right *Anacharis canadensis*, native of North America



DISTINCTIVE TYPES AMONG AQUATICS

On the left is one of the *Potamogetons*; in the center, one of the figworts, *Herpestis rotundifolia*; on the right is the parrot's-feather, this submerged form being not as attractive as the surface-running one

family are used as surface-floaters. These tiny plants are the smallest flower-

ing plants known, consisting of scalelike plant bodies with solitary or few roots, or in some cases none at all. Some of them appear individually as mere green dots on the water, some like a few green threads.

The genus *Mayaca* forms its own family. The plants look like overgrown mosses, but have small white, three-petaled flowers. These plants may be recognized by their two-pronged leaf-tip easily seen under a lens.

A few species of *Eriocaulon*, the pipeworts, with stiff, dagger-shaped leaves in a cluster, and long-stalked heads of flowers, looking like hatpins, are also used.

Juncus repens, a rush with a flattened, two-edged stem, bearing at its joints tufts of a few flattened leaves, is cultivated under the name of underwater palm. Most rushes in fact, are swamp or wet-ground plants.

The showiest of monocotyledonous aquatics are the members of the pickerel-



THE WATER-SOLDIER, *Stratiotes aloides*, is a EUROPEAN PLANT, UNKNOWN TO AMERICAN GARDENS AND REALLY WORTH CULTIVATING. THE WHITE FLOWER IS AN INCH ACROSS. ADAPTED FROM *Water-plants* BY AGNES ARBER

weed family. Some of these have fleshy, round, or elliptic leaves, and grow in mud or shallow water; some float by means of inflated spongy leaf-stalks, and some have grasslike leaves. All, except one yellow species of the grassy-leaved ones, have blue or lilac flowers.

Passing into the dicotyledonous division of plants, the number of aquatics is proportionately much smaller.

In the buttercup genus are nearly a score of aquatic species with finely dissected leaves, long floating stems, and white or yellow flowers. Some have the surface leaves cut or lobed but not dissected.

The beauties among aquatics are the water lilies. The fanworts, genus *Cabomba*, scarcely betray their relationship to the true water lilies, for they have finely dissected, opposite leaves on a stem that trails through the water; only at flowering time do a few round or elliptic floating leaves develop.

The water shield, *Brasenia*, has elliptic, floating leaves with the stalk centrally attached, giving them the appearance responsible for the common name. The lotuses have very large shieldlike leaves borne well above the water, and large yellow, white, or pink flowers.

The true water lilies, whose round, floating leaves and beautiful sweet-scented flowers in shades of white, yellow, pink, rose, red, blue, and purple, and with variously purple-mottled leaves, are familiar water-garden subjects. The spatterdocks or yellow pond lilies have similar leaves, but their flowers are less showy, appearing like small, yellow balls afloat. In the young state they are frequently used in aquaria, as their earlier leaves are submerged. Most of the remaining members of this family, although equally attractive, are too large for home cultivation.

Ceratophyllum, the hornwort, which forms its own family and is also appro-



TWO RECENTLY INTRODUCED AQUATICS

On the left is *Mayaca fluviatilis* of tropical America; on the right *Naias flexilis robusta*, more stiff-growing than the typical form



SOME LITTLE USED PLANTS

On the left is shown a species of *Eriocaulon*. In the center is a species of *Eryngium*, member of the carrot family; the one on the right is the water-shield, *Brasenia Schreberi*, a seedling plant. Above is a species of *Utricularia* (bladderwort)

priately called mare's-tail, coontail, or foptail, is a submerged plant with close whorls of forked, threadlike leaves, a beautiful thing in an aquarium.

In the mustard family, the aquatics are the well-known watercress, and the tiny, little-known awlwort, *Subularia*. The tiny plants such as *Subularia*, *Limo-*

sella, and *Littorella* should be particularly useful in underwater landscaping where subjects which will never reach a large size are desired.

In the sundew family, *Aldrovanda*, a relative of the Venus's flytrap, has the same habit of growth as the hornwort, with the addition of leaf-tips formed to catch insects by a quick spring motion.

The spurge family has but one true aquatic representative, *Phyllanthus fluitans*, of South America. It is a floating or shallow-water plant with a running stem bearing nearly round leaves, and looks much like a *Salvinia*.

The genus *Callitriche* has members which are similar in appearance to and often confused with *Anacharis*. In fact, they go by the name of dwarf-anacharis. These may, however, be distinguished by the three veins in the leaves, whereas in the true genus *Anacharis* there is only one vein. So similar to *Callitriche* that flowers are sometimes required to determine which is which, is the waterwort,



BUCKBEAN, *Menyanthes trifoliata*, A HANDSOME PLANT OF COLD BOGS IN EURASIA AND NORTH AMERICA

Elatine, member of a small aquatic family.

In the evening-primrose family, members of the genus *Isnardia*, called Ludwigias by reason of their original botanical name, are much used. They have obovate often reddish leaves on long running stems. The sister genus *Ludwigiantha*, with short, narrow leaves, is often confused with it.

The water-nuts, interesting natives of Europe and Asia, with peculiarly shaped floating leaves and horned, nutlike fruits, are excellent for outdoor pools or ponds.

The popular water-milfoils, *Myriophyllum*, are the most feathery of all aquatics, with their stems densely clothed with finely dissected leaves. The closely related genus *Proserpinaca* is a delicate plant when grown submerged, quite similar but less leafy. The true mare's-tail, *Hippuris*, with leaves like *Anacharis*,



THE FOUR-LEAF WATER-CLOVER, *Marsilea uncinata* — ACTUALLY A FERN RELATIVE—TYPICAL OF MANY OF THE 53 SPECIES OF THE GENUS

but in whorls of 6–12 each, is also a member of the same family.

The pennywort, *Hydrocotyle*, often found bordering wet meadows, or in



EFFECTIVE CONTRAST

In the center is a splendid aquatic, the red-stemmed, brownish-leaved form of a species of *Myriophyllum*. The moneywort, *Lysimachia Nummularia*, is shown at the left, and on the right is water-hyssop, *Hydrocotyle caroliniana* of the figwort family



THE MERMAID-WEED, *PROSERPINACA PECTINATA*

A native of cold swamps in North America. Related to the water-milfoils, this plant is coarser and more densely leafy when grown in shallow water

shallow water, is being grown as an aquarium plant. A member of the carrot family, it has running stems from which long-stalked, round leaves arise. *Lilaeopsis*, a related genus, has flattened, paddle-shaped leaves only about an inch long. Other members of this family will develop finely cut leaves when grown under water.

Among the primroses, two wet-ground plants are used—the water-pimpernel, with a lettuce-like cluster of small leaves, and the moneywort or creeping-Charlie, with long flexible stems and small round leaves in pairs.

Noteworthy as truly aquatic, and not yet in cultivation, are the two feather-

foils, *Hottonia inflata*, the curious American species, and *Hottonia palustris*, the European, which resembles a milfoil, except for the spike of purplish flowers which gives it the name of water violet.

In the buckbean tribe of the gentian family, we find a few interesting genera. Best known of these is the genus *Nymphoides*, called floating-heart, or water-snowflake, with heart-shaped, floating leaves, and clusters of short-stalked white or yellow flowers at the base of each leaf. The buckbean, *Menyanthes trifoliata*, with large, fleshy, clover-like leaves and a handsome spike of hairy, pinkish-white flowers, is a good subject for shallow ponds.

Among the figworts, the family of the foxgloves and snapdragons, there are many creeping plants with small round or paddle-shaped leaves which grow in shallow water, among them the mudwort, *Limosella*, which alters its leaves to rushlike ones when submerged. One Oriental genus, *Limnophila*, which has delicate, finely cut leaves similar to those of *Myriophyllum* is worth attempting to obtain from Asia.

The family from which we obtain sesame or benne-seed has an aquatic member, *Trapella*, with leaves and seed pods somewhat like those of the waternut, but with tubular flowers. This rare Chinese plant is deserving of cultivation.

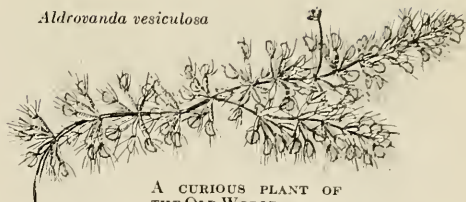
The largely aquatic family of the bladderworts has many members which grow floating just beneath the surface of the water. They have slender stems and leaves so finely dissected as to appear like clusters of green threads. These leaves bear tiny bladders with bristles at their mouths, in which minute aquatic animals are trapped.

Among the plantains, the shoreweed *Littorella* is the only aquatic—a small plant with rushlike leaves one or two inches long.

In the Lobelia family, *Lobelia Dortmanna*, the water lobelia is aquatic. This has a cluster of short, blunt, rushlike leaves, with a flowering stalk which rises well above the water.

The family of the daisies and thistles has fine aquatic members which might well be cultivated. *Sclerolepis*, native of southern coastal swamps, is similar in appearance to the mare's-tail, *Hippuris*, but has a head of pink flowers. The water-marigold of northeastern North America, *Bidens Beckii*, has leaves much like *Cabomba*, but more finely cut, and a daisy-like head of yellow flowers. The genus *Cotula* has a member with *Cera-*

Aldrovanda vesiculosa



A CURIOUS PLANT OF THE OLD WORLD, WHOSE LEAVES ACT AS "FLY TRAPS." ADAPTED FROM ENGLER & PRANTL. *Pflanzenfamilien*

trophyllum-like leaves, growing only on the Cape of Good Hope. The two genera *Pectis* and *Erigeron* each have a desirable aquatic member in Mexico.

Besides the preceding flowering plants, a number of algæ, hepatics, mosses, ferns, and fern-allies are also aquatic and greatly ornamental.

Among the algæ the two genera *Chara* and *Nitella* are used in aquaria. These plants consist of many much-branched green stems, the stems having whorls of branches, which are commonly again branched.

Among the hepatics, *Riccia fluitans* is used, forming carpets of green on or just under the surface of the

water. The plant-bodies are long, slender, and forked. [Another member of the same family, *Ricciocarpus natans*, broader and coarser and floating on the surface, is rarely found in aquaria, but might well be more widely introduced.

Among the mosses the genus *Fontinalis* is best known, its long, much-branched plants growing attached to rocks, the branches floating in the water. In the genus *Sphagnum* are some species which can be made aquatic. These have brown stems and the dense branches are closely set with pale yellow-green leaves, which usually lose all color when submerged for a long time. These, with *Potamogeton*



AQUATIC BUTTERCUPS. — THREE TYPES OF WATER-CROWFOOTS, *Ranunculus Lenormandi*, *R. heterophyllum*, *R. trichophyllum*. NATIVES OF EUROPE. NONE OF THESE IS KNOWN TO AMERICAN WATER-GARDENERS. ADAPTED FROM *Further Illustrations of the British Flora* BY BUTCHER & STRUDWICK



Trapella sinensis, A RARE FLOATING PLANT NATIVE OF CHINA, AND UNKNOWN TO CULTIVATION. ADAPTED FROM *Annals of Botany*

and *Ceratophyllum* require cool water for growth. Other mosses no doubt will also be found usable as aquaria are developed.

Among the ferns the genus *Ceratopteris*, known as floating ferns, are attractive underwater as well as floating plants. They have much-branched, coarse, fern-like leaves when mature, but in the young stage are not divided, but are frequently deep-lobed.

Among the fern-allies the number of aquatics is larger. The genus *Azolla* floats on the surface, its plant-body resembling a *Riccia*, but more frilly and lacelike. *Salvinia* also floats on the surface, its round, hairy fronds and feathery "roots"—which are strangely modified leaves—being distinctly attractive. Members of the genus *Marsilea* are very popular, but identification of species is impossible without the fruiting-bodies. All of them have four-parted, long-stalked leaves which somewhat resemble four-leaf clovers. The quillworts, *Isoetes*, have long tufts of tubular leaves, in the bulblike bases of which are borne the reproductive spores. The plants look like clumps of seedling onions, and all of them may be grown completely submerged.

Some amphibious plants still retain the ability to become either terrestrial or aquatic, as will be found by planting

seeds in soil both above and under water, in which case, although the first-formed leaves are similar, later ones will take on totally different forms. Many swamp plants or even those of damp ground may be adapted to aquatic conditions, in which case the process can be observed in the change of leaf-form. Plants with long, narrow, untoothed leaves become narrower and longer in proportion, while those with toothed or broad leaves become dissected, and some lose the leaf-blade entirely, the more or less modified petioles serving as leaves.

Water plants naturally are much more widespread than land plants, because their seeds are often carried by migrating water fowl, and because water conditions in different regions are so much more alike than those of land, that these plants have less difficulty in taking hold.

One should use extreme care, therefore, as to what aquatic plants are allowed to spread in the open, as a lesson has been learned by the introduction of the South American water-hyacinth into Florida and tropical Asia and the introduction of the water-weed into Europe. In both cases, the plants spread with such rapidity as to choke up navigable waters, thus presenting serious problems of eradication.



THE WATER-SNOWFLAKE, *Nymphoides indicum*, NATIVE OF ASIATIC TROPICS



A Leaping Mako

THE GREAT MAKO

An American Angler Makes the First Photographic Record of One of the Most Fearless Leaping Game Fishes of New Zealand Waters

By ZANE GREY

The following article is especially interesting because it is the first account ever published, according to Dr. E. W. Gudger, bibliographer and associate of the department of ichthyology of the American Museum, of a shark that leaps when hooked. The photographs, too, illustrate for the first time this leaping fighter of the South Seas. NATURAL HISTORY is especially pleased, therefore, to present this account to its readers, and regrets that lack of space prevents the publication of all of the material submitted by Mr. Grey. The narrative will, however, amply demonstrate that Mr. Grey's claims for the mako are well founded.

—THE EDITORS.

DURING the nine months of my New Zealand fishing, spread out in the summer seasons of 1926, 1927, and 1929, my bag of mako, to use an English sporting phrase, numbered somewhere in the neighborhood of seventy in all. Naturally, I lost a good many, especially the first year. The mako is a fish that often gets away. I had kept strict account of the larger ones, over 300 pounds; and I have caught ten of 400 or over, and one of 580 pounds. The last began to get into a class with big mako. I have hooked and lost several larger than that. And I have seen almost as many as I have caught myself, caught altogether by my brother, R. C., by my son Romer, and Captain Laurie Mitchell.

Romer's big mako weighed 609 pounds, a really big one, an ugly brute in this case, cut and scarred by fights with his own and other kinds of fish. And he never showed once during the battle, fighting deep and doggedly for two hours. R. C. caught a grand leaper off the Great Barrier Island, a shark well over 300 pounds, and one that exemplified all I claim for this class of fish. Captain Mitchell's famous strike of a 1200-pound mako at Cape Brett, and the loss of his line after two magnificent leaps, I have written about elsewhere. Altogether, I have had a varied and full experience with mako shark.

The highest jump I have ever photographed up to 1932, is reproduced herewith. This mako, weighing some 400



FIGHTING A MAKU

Let no one imagine that there is no danger in angling for these monsters of the deep. Mr. Grey, shown in this picture, has had many narrow escapes from serious injury and several from death while so engaged. He compares this activity with tiger or elephant hunting

odd pounds, leaped pretty close to twenty feet higher than Captain Mitchell's boat. I saw another, at a distance of two miles, flash white as snow as it shot above the same boat to a height of many feet. Both these mako escaped. At Cape Brett I saw one hooked by C. Alma Baker—a 503-pound shark that leaped six times behind the boat, all leaps from close to the same place, the second higher than the first, the third highest, and nearly thirty feet, and the remaining three graduating down. This shark turned over twice in the air at the top of his jump—on the second and third jumps—a performance that I would give much to record in motion pictures. I had one do almost the same for me.

Mako leap every way under the sun.

But they always come up stiff as a poker. The energy is released under water. Swordfish, tuna, sailfish, tarpon, kingfish, dolphin—all the great leapers—move their bodies, gills, fins, tails, in the air. Not so the mako.

The vitality of the mako is almost equal to that of the broadbill swordfish. The heart muscle is extraordinarily strong and probably beats for quite a period after death. I caught a mako once (268 pounds) that had the point of a marlin swordfish spear imbedded in the roof of its mouth. It had been there a long time.

Peter, my boatman, records the catching of a mako that carried over two feet of a marlin spear in its back, the point protruding more than six inches just



AN ARISTOCRAT AMONG SHARKS

The mako is beautiful to look at, with dark blue back, white underside, spear-pointed head, and staring, cold black eyes, wide wing-shaped fins, and magnificent tail. As a leaper, this shark is in a class by itself

below the dorsal fin; and the large end of the spear had gone clear into the flesh, which had grown over and healed. This is a remarkable instance of the ability of the mako to recover from serious injury.

Remoras or pilot or sucking-fish are found on mako as well as on other sharks and swordfish. On December 30, 1932, I brought up a mako attended by two violet, black-barred remoras of a species we did not know. We had never seen any like them, nor heard nor read of them.

Early in December, 1932, I pitched camp on a bold promontary overlooking the islands of Mercury Bay, and about one hour's run for a fast launch from the fishing banks off Red Mercury Island.

Probably this was not the most beautiful camp-site I ever saw, but it was strik-

ingly romantic and magnificent. A high sugar-loaf bluff that connected a narrow strip of white sand beach to the mainland, marked the site. We cut a trail from the beach to a ravine that divided two knolls upon which stood many marvelous specimens of the *puhutakana* trees—the scarlet Christmas trees of New Zealand. Many of these were in full bloom, the deepest and rarest hue of which was a rich magenta. I have seen only one blossoming tree superior to the *puhutakana*—the *flamboyant*, or flame tree of Tahiti.

The outlook upon the islands of the bay and the cold dark sea was magnificent in the extreme. The islands are of volcanic origin, some of lava, some of gravel in cemented strata, others of white, bold bluffs of chalk or pumice, all showing the



LEAPING FULLY FIFTEEN FEET ABOVE THE BOAT

The mako is a veritable engine of destruction, and in its fearlessness and ferocity when brought to the boat, it will bite anything. It will snap the blade off an oar or tear a man to pieces if it gets a chance

ruggedness of an iron-bound coast, of the ravages of an insatiate sea. Far out the Aldermans raised their saw-tooth heads and, beyond them, Mayor Island blurred round over the horizon. All these features of the Southern Hemisphere seemed to furnish a savage and harmonious background for the great mako.

This season was marked by an unusual abundance of trevalli and kahawai. On fair days we ran through schools of these wonderful bait fish, and off Red Mercury on the banks we often counted as many as ten schools in sight at one time. Nowhere else in the Seven Seas can the like be seen. These schools will cover an acre of water and go down almost solid for fifty feet. They feed on plankton, tiny fish of the reefs, that can be seen moving over and through the water, a shining mass, impossible to credit without actual visualization. The fishes of the upper layer swim with mouths agape, gulping in the plank-

ton, and making a sound not unlike the continuous rush and babble of a brook. When a mako or swordfish charges one of these schools, it vanishes in a white, roaring splash.

These schools of bait presented a most fascinating study to me and a source of thrilling sport. They showed way out in the open sea, a mile off Red Mercury and ten miles from the mainland.

"Lone Angler" Wiborn, my fishing partner, gave me the same supercilious little glance and quiet smile that my brother R. C. once gave me when I handed over an ideal mako tackle and said: "Careful now! You've got to unlearn some things. I don't care how much tackle you break or lose overboard. But—look out for your hands. Wear double gloves. And when you fetch your mako up to gaff, unbuckle your harness, release your drag, slip out of your chair while holding your rod—and watch that

whipping wire leader and don't let it fly round your neck. You'd lose your head!"

R. C.'s brotherly reply to that was: "Well, Zane, I don't see how that could have made any great difference to you. You never had a head anyhow!"

"Lone Angler" said: "Me break tackle? Why, I never use brute strength on fish. Only skill! I've seen the day I could run any boat alone—lick one of your old mako and eat an ice cream cone at the same time."

To both these old comrades of the rod I laughed sardonically: "Ha! Ha! Ha! Ha! Ha!"



On the second day of our New Zealand sojourn the season of 1932-33, I saw some white splashes back of the "Avalon," out of which Wiborn was fishing. We were pretty far away and I could not see a fish, but I told Peter to take the glass and see if they were hooked on.

"Right-o, sir," said Peter, with alacrity, and levelled the glass at the launch between us and Red Mercury Island. "It's a mako, sir. . . . Looks like they are having trouble. . . . By Jove! . . . They're running away from the fish!"

"Hook up. Let's run over," I replied, taking the glass. One glance confirmed Peter's fears. Wiborn was on his first mako. He and the two boatmen appeared to be going through some strenuous antics which were occasioned by a mean and lively mako that was flying in the air when he was not tearing the water white. I sustained a moment of fiendish glee.

Flying spray from our bow spoiled my view until the "Frangipani" slowed up and turned to run close to the "Avalon." Whatever had been doing was over. Lone Angler sat in his fishing chair, sort of red in the face, and pop-eyed; and his rod lay limp over the gun-



ONE OF THE FIRST PHOTOGRAPHIC RECORDS OF THE MAKU'S LEAP

This mako leaped so high that the still camera failed to record the splash and proof of a thirty-foot leap. The motion-picture machine, however, caught it successfully

wale at right angles with a slack line floating on the water. The boatman Cook appeared to be bandaging his hands, and the boy Vic stood staring into vacancy.

I hailed Wiborn: "Hello, there, Lone Angler! We saw you'd hung a fish. What was it?"

"It wasn't a fish," declared he.

"No? . . . What, then?"

"It was one of those flying devils. . . . Blue and white. . . . With a mouth like a subway entrance with spiked gates."

"Mako! I thought so. He looked pretty husky. Where is he?"

"I've an idea he had an engagement in the China Sea. He was in something of a hurry."

"I see. . . . Broke off. Only an incident of New Zealand angling. . . . He busted your rod."

"I should say not. It was *your* rod."

"Fine! I'm tickled pink. What else did he do?"

"Well, he knocked that small gaff sky-high."

"You should have used the big detachable with the long rope."

"We did."

"Oh! Missed him, eh?"

"No. He took that gaff with him."

"Not my big detachable!" I ejaculated, incredulously.

"We needed a mile of rope."

"So?—I'm sure glad I didn't give you one of the expensive gaffs to practice with."

Here Peter chimed in: "Hey, Neville, how could you lose a detachable gaff with sixty fathoms of rope?"

"Hub!—He took it—like greased lightning. Look at my hands," returned the boatman, grimly.

"Didn't you put on gloves?"

"Forgot."

Here the boy Vic added his mite: "I wrapped my shirt around my hands. He took that, too."

I laughed. "Well, you seem to have

had some trouble with a little mako. What will you do with a big one?"

"Say, I came down here to fish. Not to fight ocean monsters," retorted Wiborn.

"You'll learn. It's all in the day's work. . . . Take a couple more gaffs and try again."

That day I caught a 682-pound thresher shark, a fine fighting fish that took three hours to whip. He did not leap, which is something threshers do rarely and is a wonderful spectacle. When we came ashore at camp that evening, Wiborn was waiting to see my thresher hung up and photographed.

"Some fish! Some queer, hideous fish, believe me! . . . I thought you had hooked the bottom of the ocean. I never saw a rod bent like that. It was great stuff. I learned a lot watching you."

"What happened to you?"

"I don't remember exactly, but it was a lot. I had a fine strike—let him run—hooked him O.K. He fell heavy, but came in easily. It was a mako. Wonderful fish! Blue as a tuna! He had cold, black, glittering eyes. . . . My boatman wanted to harpoon him. I said "Nix," and made him gaff him. My lord! I thought we'd been hit by an exploding mine. The gaff was thrown thirty feet. My mako ran off a hundred yards. It was hell to pump and reel him back. I told Neville to try the big gaff. He said the fish wasn't ready. He ran the boat away from the mako. Fact is he was scared stiff. I couldn't hold the mako under such conditions, so I made Neville take a soak at it with the big gaff. All he did was prick the brute. Then I had hard work saving tackle from going with the shark. Again, at greater pains, I hauled the mako back. This time the gaff went in. There was a tremendous thumping splash. The gaff rope whizzed out. Burned both men's hands till they let go. Gone in a flash! And he broke my rod and then my line."



AGAINST A BACKGROUND OF SEA GULLS

The leaping qualities of the mako are beautifully shown in this photograph. Mr. Grey went to New Zealand solely to photograph this great leaper both in still and motion pictures

"What do you think of the mako?" I asked.

"My first impression is that he has a mean disposition," replied Lone Angler, evasively.

Next day I caught two mako, 286 and 300 pounds, both of which performed for Wiborn's edification, and which drove my camera-men, Emil and Andy, into wild ravings.

"Say, you haven't seen anything, yet," I declared. "A couple of good jumps! Wait till I hang a big mako."

It chanced that Wiborn was the first to

have that great sport. We got our bait at Whale Rock, a long, gray, hump-backed ledge, around which the Kahawai and trevalli swam in huge schools.

These schools of small fish, from five to eight pounds in weight, are what attract the big fish in from the sea. The first-named can be caught on almost any kind of a trolled lure, a brown or black gig being the best, but the trevalli have to be snagged. When I first came to New Zealand, no angler had ever tried a trevalli for bait, for the simple reason that they could not be caught. When I



THE GREAT MAKO (*ISURUS*)

This 580-pound mako reveals the wonderful build and line of the species

found that all the big fish like trevalli better than kahawai, I devised a way to catch them. We cast into the schools with a leaded gang hook, and jerk hard. On a light rod a trevalli puts up an exceedingly hard fight. My followers at this method never use rods, but hand lines. And at that they prefer kahawai because they are easy to catch. My claim is that trevalli are the best bait I have ever used. They troll easy, being wide and flat, and, used as live bait, they simply swim down and hunt up a big mako or swordfish.

This morning we got our bait quickly

and headed for Red Mercury Island, trolling on the way. Before we were half a mile from Whale Rock, I raised and hooked a small mako, which we could not induce or drive to leap. Just after that, however, Wiborn on the "Avalon," had one of the marvelous leaping mako strikes about which I have written so much.

The big mako struck Wiborn's trolled bait and came out in a magnificent leap, shining in the sunlight, a beautiful blue and white shark thrilling to see. He dropped back in a huge splash and sounded. This fish, no doubt, hooked himself before Wiborn had a chance to jerk.

We ran as close as we dared, Emil and I with still cameras, and Anderson on top with the Mitchell moving picture camera. We waited in keen anticipation.

But nothing happened, except Wiborn's efforts to bring the dogged mako to the surface. When an hour passed without the shark showing, I began to fear this particular mako was not going to perform of his own accord. And I was doubtful about Wiborn's boatmen being either desirous or capable of making the shark leap.

In cases like this, I usually grow impatient and relax vigilance, when as a matter of fact the thing to do is to be all the keener. We changed position from time to time, according to where the shark

was, and we always tried to keep him between us and the "Avalon." After about a half hour more Wiborn appeared to be getting the upper hand and had the mako close. Its big fin, sharp and triangular, cut the surface. We ran closer, hoping to get pictures of what happened at the gaff; and we were perhaps two hundred feet away when the mako leaped unexpectedly.

He came out slick and fast, without a splash, and as he swept upward, stiff as a poker, gleaming blue-white, with wide pectorals spread and huge tail curled, his great savage head narrowing to a spear point, he was assuredly a spectacle to fire any angler. I yelled with the rest of them. But I was out of position and could not get my camera around in time. Emil, however, snapped him with a

ringing yell. I jumped out to be ready for a second leap. It came—a long, low, grey-hound bound over the sea, ending in a furious white splash as large as my boat. That time I nailed him on the film. But it would have been better if I had waited. He shot out so close to our bow that he could have been touched, and he went up to half the height of our mast, fifteen feet above the water, and turned in the air to smack down with a resounding roar. I missed that shot because I could not lean over the gunwale far enough. Then, when he split the water just opposite the cockpit and frightfully close, I was too excited, thrilled, and scared to remember my camera. I would have been out of focus anyway. We waited, tingling in suspense, but he did not leap again.

All this had happened in a few seconds.



THE WOLF OF THE SEA

Legends handed down by the forebears of the Maoris attest to the fear their fishermen had of this sea brute. The mako's great, lancelike, ivory teeth are highly prized

Emil was raving because he had gotten only two snaps.

"Andy," I yelled. "Did you get any of it?"

"Did I?—I got it all!—Must have had a hunch. Threw on the juice just before that first leap—caught him in the fender—and panned all the rest. . . . You can gamble that mako is in the little black box."

"Grand, Andy! It's the first time with a movie. . . . What did you think of him?"

"Swell! Looked like an airplane. On the third jump he didn't miss us far. And on the last he splashed water all over me."

"Look sharp. He might break out again," I concluded.

But he did not. He stayed down deep and wore himself out in the succeeding half hour, so that when Lone Angler finally hauled him up to the boat and the gaff he had only one wag left. They held him and the fight was over.

That afternoon we ran in with flags flying. While the boatmen towed the big mako to shore, Lone Angler paid him this tribute:

"When he came out on the strike, I had the thrill of my life. He's not a fish. He's a torpedo. Never in my life had I seen such a magnificent fish spectacle as his leaping. He was a stubborn, strong fighter, too. . . . You are right to put the mako in a class by himself."

This mako weighed 486 pounds. He was in fine condition and did not have a scar, which was something unusual for a mako of that size.

Wiborn's next notable experience with a mako occurred some days after that. They sighted one on the surface and circled him with a bait. He took it. Wiborn promptly struck him, and passed the rod to his boatman so that he could use a camera, and that mako flashed straight for the boat, coming like a streak on the surface. He seized the rudder in

his powerful jaws and churned the water into seething foam in his efforts to bite it off. It was iron, of course, and he could not do much damage, except to his teeth. Neither was he huge enough to tear the rudder off, as the sharks do at Suva. But he got away.

I would have given a good deal to have seen this attack. Wiborn was profoundly impressed.

During the next several weeks, before the swordfish came, we caught a dozen or more mako, losing half that number as well; and all of them more or less leaped and fought for us to the augmenting of our respect and admiration. In most instances we had to rouse them to battle. One of my mako, a 350-pound specimen, must have had a skin so tough that it was well-nigh impregnable. While Peter held the mako by the leader, Reuben, my engineer, attempted to gaff it. He failed three times, after each of which the mako raised merry hell, jerked free for me to do the work of hauling him back again. After this Peter let Reuben take the leader and he struck with the gaff. It would not go in. And there was another terrific maelstrom. The mako raced away and I had to pull him back. This happened again and again. Not until the fourth attempt did Peter get that gaff to hold.

Cruising between Richard's Rock and Red Mercury one afternoon, I espied a sharp, blue fin cutting the surface. The sea was running pretty high. We had difficulty in keeping track of this mako. We would see him again and then lose him. Finally we thought he was gone for good, when Wiborn, who was following in the "Avalon," sighted him for us. This time we got in front of him. We let out two baits, one about a hundred feet, the other about fifty. The mako disappeared. I was exclaiming at our awkwardness in missing him, when we had a hard pull on the closer bait. He had



THE CLEANEST PHOTOGRAPH EVER TAKEN OF A MAKO LEAPING

The market fishermen of New Zealand hate and fear the mako, and leave him severely alone rather than risk injury or death to themselves, and certain loss of their fishing gear

seen that one first. I reeled in the other as fast as I could. But I had not gotten it near the boat when there came a broad, greenish-blue flash, then a dark fish shape, and then the mako showed at my bait, a wonderful fish magnifying all the gamy points of the species, and of large size.

He swam at us, no doubt looking for another bait. We had him on two lines.

"Grab that rod and swack him, Peter," I yelled, putting on my drag.

We struck together. Thrillingly I expected that mako to tear the water to shreds and shoot into the air. But he just followed us, if not menacing, then surely curious.

"Rush, run away from him. Quick!" I ordered.

With a hundred yards of water between us we felt safer. But he came at us, and succeeded in biting off the line of the rod Peter held. That was good. It is

difficult to handle a vicious fish on two rods. I tightened up on this mako and lay back on the rod. He was the heaviest fish I had had hold of that season. I prayed he would leap. But he did not like the strain of the line. He followed it up. He hunted trouble. We ran away from him until I got tired of it and angry with him.

"Come on. Let's stick him!"

"Right-o. We'll wake the plugger up!" replied Peter.

While I settled down to hauling the shark close, Peter got the long, spiked pole which we kept on board for the purpose of irritating these curious and callous mako without disabling them. It looked as if the stage was all set for a thrilling scene. Wiborn was close at hand on the "Avalon." My camera-men were on edge.

It developed that I did not have to drag the mako to the boat. Presently he



THE AUCKLAND MARKET FISHERMAN'S NIGHTMARE

Mako hang around the fishing grounds and interfere with the market fishermen at their work. They sometimes snatch off the schnapper and tear off *hapauka* and occasionally get hooked themselves

came so fast that I had to wind equally fast to keep the line tight. We saw him come with a swell. And, oh! was he not beautiful? I overestimated his size and weight, but that was one of the fallacies of angling.

The swivel of my thirty-foot leader stopped at the tip of my rod. Still the mako came on until, for me, he disappeared behind the combing. Then Peter lunged out with the pole. In a roar of white water that blinded me, my mako was off to the races. He ran two hundred yards on the drag before slowing up. But to our intense disappointment he did not leap.

"We'll have another go at him," I shouted, and bent to the laborious job of pulling the mako back. It was hard work this time. He did not want anything to do with us. But as he would not sound I soon pumped him in. Peter gave him another jab with the spiked pole. He

thumped the water like a whale with his flukes. He left a huge boil in the water and he ran clear to Wiborn's boat and almost under it. If he had only leaped! There we had three cameras trained on him. We had him between the boats. But he would not do it.

"Stay with him, old Red and Blue. Make him jump!" called my college mate.

This time it took long to work the mako back. He fought sullenly. He had weight. He was like a log. I was a quarter of an hour straining, winding, burning, sweating, on that mako, before I had the leader again where Peter could reach it. Peter was mad, now. He had the long spear instead of the spiked pole. And Peter was a whaler. He stuck that mako far back toward the tail, where a mako is sensitive if he has any feeling. Anticipating a deluge, I had slipped out of my chair, harness unbuckled, my gloved

hands on the reel to prevent an overrun of the line, and I saw the great shark as Peter struck him. Then he disappeared in a whirlpool of spray and my line ripped off my reel.

No good! He would not jump for us. I had another back-breaking task. But I would not give up, and we soon had another try at him. The result was equally as explosive, as wet, as disappointing and futile. In our passion to make him jump for the cameras, we utterly lost sight of the game fight he was putting up.

Three more attempts we made before I tired, after the last of which I told Peter to gaff him next time. The next time did not come soon. I had to extend myself to start the mako back—to get his head turned our way. And, at last, when I saw the shining brass leader come out, it was none too soon for me.

"Get ready—gloves—big gaff—careful of—the leader," I panted.

Reuben had to leave the wheel to take the leader from Peter. I was out of the chair, ready to duck. Peter bent low. He lunged. *Crash!* Peter almost went overboard. His yell was only a whisper in the threshing of water. The gaff-rope paid out, and so did my line. Both men fell in the cockpit, hanging on to the rope. Emil leaped to lend his aid.

The three of them stopped the mako before all the rope was gone. Then began the strain and heave of hauling him back. I wound up my slack line without getting into the

chair, and kept watch for the mako. At last he showed, broadside, limned dark against the blood-stained water—gaping, his terrible jaws spread, his wide, weary tail churning the water. He was overcome but not beaten. He had the diabolical eye of a creature that would kill as he was being killed. And as Reuben lassoed that waving tail, the mako lurched out with snapping jaws, half way up to the gunwale, to sink his teeth on the side of the boat. That was his last gesture.

I never loved sharks, but at that moment I repented of my lust to kill these death-dealing engines of the deep. If he had only leaped, I would have let him be the last mako to fall to my rod! But he would not leap. He was the ninetyeth mako for me and that should be enough. He weighed 510 pounds and was the second largest I had caught. No doubt, however, he came first in exemplifying the claims I had made—that he was New Zealand's premier sporting fish, as game as he was beautiful, as ferocious as he was enduring. It could not be proved against him that, like the white shark, the tiger shark, the gray nurse, the blue-pointer, and the terrible man-eaters of the Indian Ocean, he would stalk men in the water to eat them, but I knew beyond peradventure of doubt

that, when provoked or hurt, the mako would kill, and added to that, if he was hungry and tasted blood, he would become as ravenous as any other shark.





Mundugumor Dancers Wearing Headdresses of Cassowary Feathers

TAMBERANS AND TUMBUANS IN NEW GUINEA

An Account of the Way in Which the Various Tribes of the Sepik District of New Guinea Borrow the Ceremonial Paraphernalia of the Secret Ceremonies of Other Tribes and Fit it Into Their Own Dramatic and Religious Patterns

By MARGARET MEAD

Assistant Curator of Ethnology, American Museum

Note.—As the keynote to New Guinea culture is the distinction between the initiated and the uninitiated, the complete picture can be obtained only by investigators of both sexes, working in coöperation, and I am indebted to my husband, Dr. R. F. Fortune, for the esoteric details and attitudes in the ceremonies from which women were excluded.—M. M.

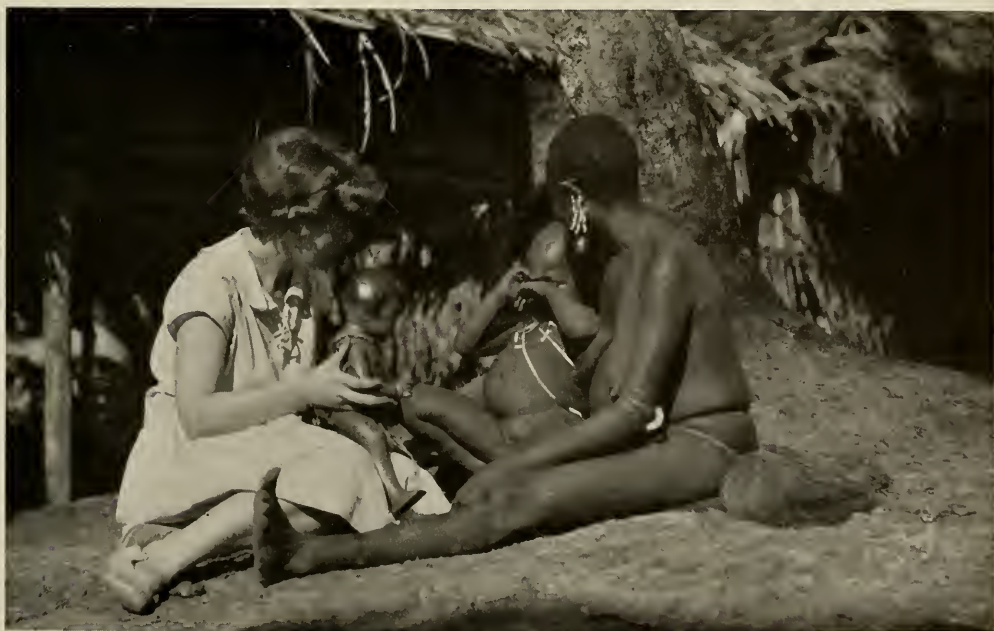
FOR many years the Sepik District of New Guinea has been known to collectors and students as a region remarkably rich in material culture. A bewildering display of masks, ornaments, headdresses, bark paintings—ceremonial paraphernalia of great diversity and brilliant colorfulness—has poured out of the region into museums and private collections. It has also been known that there were many different tribes in this region, small local groups speaking mutually unintelligible languages. The connection between the wealth and diversity of the material objects and the narrow provincialism betrayed by the number of

languages and the great diversity of social customs among different tribal groups only a few miles from each other, was not clear. Although one could guess, with very little to go upon, how useful objects like pots or plates, baskets or fish nets are manufactured in one spot and diffused to other far distant tribes, the ways in which sacred objects, articles of ritual and religious ceremonial find their way through a wall of alien custom and different speech, were not so easy of conjecture. This was one of the points which was specially investigated by my husband, Dr. Reo Fortune, and myself, on our recent two-year expedition during which we studied

three tribal groups in this region: the Arapesh tribe of the Prince Alexander Mountains, whose territory reaches across the mountains from the sea to the edge of the great Sepik grass plains; the Mundugumor tribe on the Yuat River, a tributary of the Sepik; and the Tchambuli tribe on the Aibom Lake, two days farther journey up the Sepik River. Doctor Fortune also made collecting trips among the Abelam, a more inland tribe who occupy the territory between the Arapesh and the Iatmul tribes of the Middle Sepik River.

Among all three tribes we found the same conditions; masks, headdresses, ornaments, unlike the local style and often characteristic of the domestic styles of some far-away tribe, were woven into the rich, dramatic ceremonial life of the people. Such innovations may be classified, to use the widespread pidgin English terminology of New Guinea, as "tamberans" or "tumbuans."

"Tamberans" are anything—a sound making instrument, a piece of bone, a mask—which may not be seen by uninitiated members of the tribe. Around the tamberans clusters an atmosphere of awe and dread; often they are protected by special magical charms which supposedly deal death to the uninitiated and which cling sufficiently to the initiated so that special purification ceremonies are necessary. Tamberans may become so numerous and so bulky, as among the plains Arapesh, that special houses have to be built in which they can be concealed between ceremonies. They may be tamberans by definition only, as among the mountain Arapesh, where flutes played in pairs from a hole in the side near the end are tamberans, and flutes played from the ends, in trios, are just part of a pretty musical ceremonial to which anyone may come. The most ordinary everyday article, like a net bag, may be made by women in one tribe, and carefully hidden from the sight



DOCTOR MEAD SHOWING A DOLL TO AN ARAPESH CHILD

As the Arapesh women had never seen any form of graven image, they were at first very much frightened by this doll. The men recognized it as an image and threatened that it would bring harm to the women



PAINTED BARK STRUCTURE

The Mundugumor construct these painted bark triangles as part of a yam feast. The whole surface is treated as a unit, of which the central design is a crocodile

of women in another tribe, to which it has been sold by a devious route. But the conception of a tamberan, something sacred, forbidden and hidden, and usually impersonated for the uninitiated by some sound-making instrument, remains as an hospitable category to which the inventions and creations of other tribes may be assimilated.

Tambuans, on the contrary, are masked figures which are meant to be seen, and which are usually part of an elaborate mimetic or dramatic ceremonial. Any

kind of dance, any kind of headdress, any song and any dance step, may be imported from one tribe to another in connection with a tumbuan, a dancing masked figure which performs for the benefit of the entire community, more particularly for the benefit of the uninitiated. It is true that the song may lose all its words or these may dwindle down into nonsense syllables as they pass from tribe to tribe. Or a part of a tumbuan in one tribe may be purchased by another tribe, and fitted, not into the open dancing tumbuan pattern, but into the secret forbidden tamberan pattern. Both tamberans and tambuans contain an element of secrecy and surprise. In the first case it is the secrecy of the temple into which only the duly initiated may enter, there to be amazed and surprised at the simplicity of the noise-making device

which in childhood they heard attributed to supernatural monsters; with tambuans the secrecy of the temple is exchanged for the secrecy of the green room;—dressing rooms, walled enclosures, leggings of leaves to conceal the identity of the dancers, suspense because no one knows just when and from what direction a grotesquely masked figure will emerge, all these are substituted for the supernaturally sanctioned secrecy of the tamberan cult.

There is then the double situation: a

wide region with great diversity of natural conditions which shelters numberless small, highly individualized tribal groups, who cling to the core of their own religion and customs but at the same time are attracted toward the different and therefore fascinating ceremonial paraphernalia of their neighbors, and the widespread conception of the distinction between initiated and uninitiated, on the one hand, and between grateful audience and masked performers upon the other.

By canoe, over mountain trails, along the sea coast, the netting, the shell work, the carving, the painting, of one tribe is carried, through formal and informal avenues of trade, sometimes along lines of hereditary trade friendships, sometimes by definite middlemen who buy up the theatrical and decorative possessions of one tribe and sell them in an assorted lot of masks, new styles of dress, new songs, to another tribe.

Among the plains Arapesh and the Abelam, a triangular temple is built in which tamberans are hidden; this temple has a façade which is decorated with rows of painted faces and conventional designs brilliantly done on strips of sago bark. Several tribes away, on the other side of the Sepik River, among the Mundugumor, a triangle of painted bark appears again, no longer as a façade behind which tamberans are hidden, but

as a painted triangle set up in the village as part of a yam ceremony, the original meaning of its shape and proportions entirely forgotten.

Sacred flutes are an important element in the tamberan cult of the Sepik River, and one of their richest developments is found in Tchambuli, where they are decorated with the heads of men and of birds and regarded as the voices of named guardian supernaturals or of their children. The Mundugumor have taken the idea



PLAINS ARAPESH TAMBERAN HOUSE

The Abelam and plains Arapesh build ceremonial houses constructed like hollow triangles, with a steeply sloping ridge pole. The decorated façade, made up of separate rows of paintings, is an integral part of these structures, which are sometimes 80 or 90 feet in height



WHERE A TWO-YEAR SURVEY OF NEW GUINEA CULTURE WAS MADE
Showing the locations of the four tribes from which the collections were made for the American Museum

of a sacred flute and developed and decorated it until it seems more like an idol than a flute and it is no longer possible to play upon it. The whole surface of the flute is encrusted with shells, and in the top is set a small carved figure with an enormous head and diminutive body upon which a great number of valuable shells have been arranged. These flutes are spoken of as crocodile spirit children, and each new one, after it has been secretly decorated with shells and fur and chains and feathers and a beard and ringlets of real human hair, is given ceremonial birth. Its mother, the mother crocodile spirit, is a great water drum which is hidden in an enclosure on the banks of the river. From the enclosure the new flute is triumphantly born, displayed for a moment to the whole village, then hidden away forever in wrappings of matting from which it can be unwrapped and "fed" only by the initiated.

These flutes with their heavy weight of valuable shells, are the marriage portion of Mundugumor women, and every Mundugumor bride of wealth carries with her a tambaran, which will become the property

of her eldest son. It is not surprising that under these circumstances the Mundugumor have lost sight of the fact that the principal point of a tambaran is that it is something which women may not see, and instead emphasize only the point of initiation, so that any girl who is willing to keep the food taboos incident to initiation is permitted to see the tambaran. This makes an effective division between mild, lazy, uninquisitive women and children on the one hand, who can eat the taboed foods and form a duly impressed audience for the esoteric sections of an initiation ceremony, and the older boys, men, and more aggressive women, who are permitted to witness the inner details, who know that the flute is a flute and not the voice of a new-born crocodile spirit, and that the booming of the mother crocodile is made by laboriously beating the water drum up and down on the water.

The Mundugumor take great delight in initiation ceremonies, and instead of lumping all their tambarans together and showing them to the initiates in one big ceremony, they have many kinds of tambarans, the flute forms or tumbuan

masks of neighboring tribes, into the sight of which everyone has to be initiated separately. Initiation includes not only seeing the mask or flute and thereby taking upon oneself the food taboos, but also, in the case of boys, having one's back cut with crocodile teeth, or being showered with sparks. Anyone who has not been initiated into all the different kinds of tamberans is always likely to undergo the ignominy of being asked, gently, to please not come in, or to please go out of a house, as the Mundugumor keep and display these sacred objects in their own houses. So the sanction which makes every youth consent, often morosely enough, to one initiation after another, as it suits some owner of a tamberan to give a feast and put his sacred treasure on view, is the fear that at some future time when this kind of tamberan is displayed he will be excluded from the house.

The Arapesh live some six days' journey from Mundugumor, and their initiation



IMPORTED PLAITED MASK

The Mundugumor imported this mask and incorporated it into their initiation ceremonies. They failed, however, to import also the technique of its manufacture



HOUSE PLATE MASK

This enormous wooden mask of the type used in other tribes as a gable decoration was used by the Mundugumor as a tamberan

ceremonies are very differently organized. The emphasis is upon the division between men and women for the safety and health of both, and the tamberan cult divides the sacred activities of the men from those of the women. All young boys must be initiated, not scarified as on the Sepik River, but beaten hygienically with stinging nettles, and must suffer a mild form of circumcision.

About every six or seven years some community with a larger number of young boys, a more enterprising leader, or an extra supply of yams, will give a big initiation feast. A special enclosure is built for the initiates, and their younger brothers and sisters are told that they are going to be swallowed by a monster. On the Sepik River this monster is sometimes actually pantomimed. The Iatmul tribe build a giant crocodile mouth as the gate to their initiates' enclosure, and the Mundugumor have one form of initiation



SACRED FLUTES AMONG THE ARAPESH

Arapesh men playing the paired sacred flutes in a village from which all the women have been expelled. The diminutive thatch hut shown at the right covers a newly made grave



HEAD OF A MUNDUGUMOR CROCODILE FLUTE

The Mundugumor carve small wooden figures with disproportionately large heads and insert them in the ends of bamboo flutes which have been heavily encrusted with shells. Upon the carving an enormous load of valuables is decoratively arranged



ABELAM WOMAN MAKING
A NET BAG

Manufacturing net bags is woman's work among the Abelam. Less than a hundred miles away these bags are imported and treated as tamberans which only the initiated may see



TCHAMBULI HOUSE
DECORATION

Gable decorations of this type ranging from a foot and a half to four feet in height, are placed in each gable of the Tchambuli men's house. They are brightly painted in red, white, and black, and stand out vividly against the thatch



FOLLOWING THE MASKED WHIPPING DANCERS

Doctor Mead with a group of Tehambuli women is following the masked dancers from one dancing ground to another



TCHAMBULI WATER DRUM

The water drum used on the Sepik River is an enlarged form of the hand drum

in which they build a huge crocodile of bamboo and have the older men dash out among the initiates, carrying the monster, with one small boy suspended in its mouth so that only his head shows among the bristling teeth; all the initiates are then required to crawl through the belly of the crocodile and lie as if dead at the other end.

The Arapesh have none of this drama; actually the sacred figure of their initiation ceremonies is a cassowary, not a crocodile, and the circumcisor wears a mask of cassowary feathers. But they have imported some features of the Sepik initiation ceremonies, among them the idea of a swallowing monster. This idea, meant to be so frightening, is taken very casually, and Arapesh small boys answer that they aren't afraid of being swallowed, because Badui, or Anop, looked very plump and happy after he was swallowed by the tambran. The point of the Arapesh ceremony, aside from the incising which is to make the boys grow, is to show

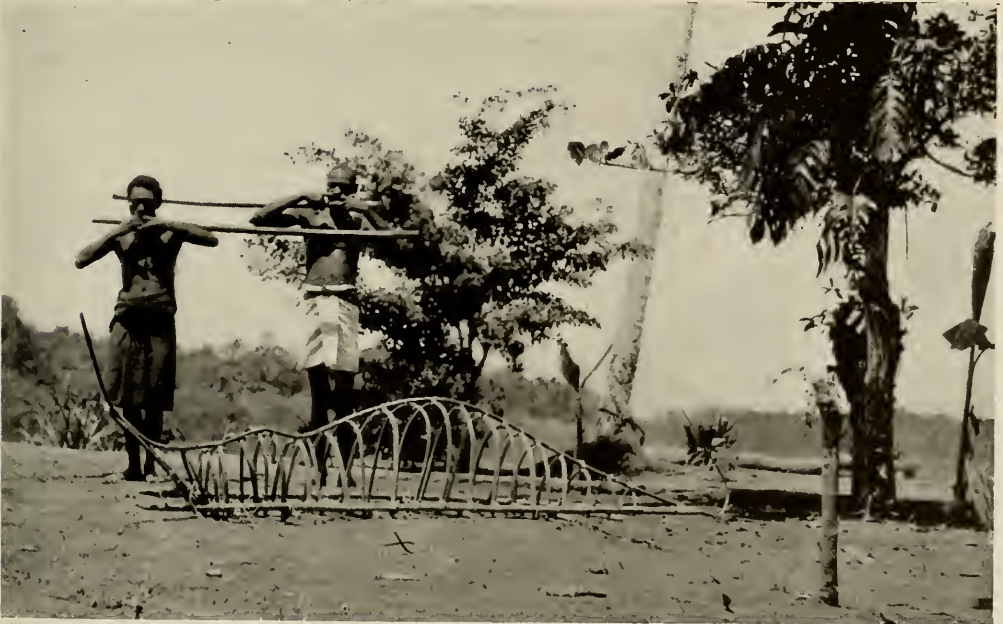
them that everything which they thought was done by supernaturals is really done by men. This is the great secret which makes one a man, and it is the height of blasphemy to say, in a moment of great rage and excitement, that there is no tamberan, there are only men.

It is further desirable to surprise and amaze the initiates, and for this purpose they are shown new and unusual things imported from other tribes or copied from imported objects. The oldest men among the Arapesh had been initiated by being shown an odd kind of mask, with the nose curved down and set fast in the chin. Today a few of these masks, still regarded with a kind of chilly awe, are hidden away on the shelves of the small tamberan house, but the whole excitement of the ceremony has changed. Where, before, the tamberan spirits were impersonated only with wooden drums and seed whistles, about twenty years ago flutes were imported from the Sepik. Only a very little of the ideology



SHELL ENCRUSTED MASK

This delicate mask is characteristic of the most beautiful type of mask made on the Sepik River



SMALL MODEL OF AN INITIATORY CROCODILE

Used in a pantomime swallowing of initiates in one type of Mundugumor initiation ceremony. This model was made for Doctor Mead with all due ceremony including flute playing



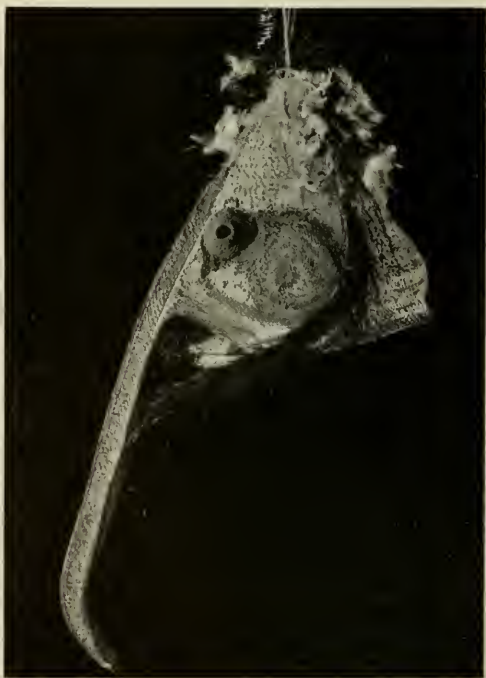
A PLAITED MASK IN THE MAKING

These masks are made of many sections, each one of which is plaited separately. In Tehambuli this is a special ceremonial task, performed by the children of the sisters of the owners of the masks

connected with them came with them, but male and female flutes were imported on the coast, and as each more inland village wished for a pair, new ones were made and said to be the children of the preceding pair; so again, many miles away, are found flutes spoken of as children, not of water drums, as in Mundugumor, nor of the sacred clan supernaturals as in Tehambuli, but simply as the children of another set of flutes. The men take the most tremendous care never to let the women see these flutes, or guess they are flutes; the women, however, distinguish between the fluting of the tamberans and the fluting of young boys by the very simple formula—"the men have not told us to run away, so obviously that sound is just a boy and not a tamberan."

Tambuans, among the Arapesh, are bought by an entire village, as the center of a complex of new styles, new songs,

new charms. For several years a village will bend all its energies to accumulating enough pigs, feathers, shell rings, and tobacco to pay to a beach village, or initially to canoe travelers from some other tribe, to persuade them to sell them one or usually two of their beautiful tambuans. When one of these tambuans is sold, the original owners sell it forever, and, after having danced in the masks in the buying village, they sorrowfully hand over the bright paraphernalia to the new owners, and weeping, leave the village. The new owners forbear to dance and sing while the old owners are traveling homeward, as the sound would make their hearts still heavier. In a few years the fancy of the owning village will be caught by some newer and different tambuan, and they will sell the old one, together with the dance steps and the



LONG-NOSED PLAITED MASK

Many variations of plaited masks are found throughout the Sepik River district. The long nose is an exaggeration of the Sepik idea of beauty



BEHIND THE SCENES IN TCHAMBULI

In the enclosure walled with coconut leaf mats, the young men are putting the finishing touches to the elaborately masked figures which will presently emerge in sets of four to dazzle the eyes of the waiting women

songs, to a still more inland village and purchase the new tumbuan with the proceeds. Songs which are being sung in the mountains are no longer sung on the beach; the old people remark with an indulgent smile that they still can hear them, that is, recognize the tune, but they have forgotten the words.

So, hidden and awe-inspiring as tamberans, or gay and laughter-giving as tumbuans, the inventions and artistic products, the songs, the dances, even small bits of belief, pass from tribe to tribe, from one end of the Sepik district to the other. Among the Arapesh, who are a poor mountain people with very slight organization and a scattered way of life, each new importation is brought in, used enthusiastically for a few years, and then sold or forgotten, to make room for a newer fad in religious or theatrical styles.

Among the Mundugumor, where each importation is owned by an individual instead of by a village, the result is a great diversity of tamberans and a most inconvenient welter of initiation ceremonies, and the weeding out process is more gradual; some tamberans are imported without any instructions for making them, or only the owner knows, and he dies without training a successor; the one, once highly valued plaited mask rots away, or the wooden mask which no one bothered to copy is eaten by borer and never replaced. Where there are already so many kinds of tamberans, no one misses them, but the would-be innovator purchases, instead, some new style from a neighboring tribe, which may in its turn either become modified and integrated into tribal life, or forgotten.

In Tchambuli a large population and the custom of different clans owning different tamberans and tumbuans, men's houses with large attics in which sacred objects can accumulate, and enormous leisure on the part of the men, have permitted a greater accumulation, so that today one finds a more complicated situation, many kinds of flutes, dog flutes and bird flutes and flutes with small carved figures and flutes with human heads; dozens and dozens of styles of plaited masks, which are made with great secrecy and ostentation in the men's club houses, and then paraded through the village; carved wooden masks in great variety, and also a motley array of sacred objects, old painted stones, archaic bits of carving, and pieces of broken pottery. In Tcham-

buli the tamberans are supposed to be only for the men, and women play the part of distant spectators, who carefully avoid referring in public to the fact that they know all about the tamberan secrets.

Perhaps it is because the secrecy is so much a matter of form and courtesy between the sexes, instead of being the pivot upon which health and growth are set, as among the Arapesh, or a matter of family pride and disciplining the refractory, as among the Mundugumor, that the Tchambuli have been able to conserve so many different art styles, many of them undoubtedly inspired originally by far distant tribes and imported at some remote period either as tamberans or tumbuans.



TCHAMBULI SACRED FLUTES



The Projection Planetarium Installed in the Hemispherical Dome

THE HAYDEN PLANETARIUM

The New Addition to the American Museum Which Will Contain the Latest Example of the Most Wonderful Device Ever Developed for Setting Forth Realistically and Impressively the Motions of the Heavenly Bodies

BY CLYDE FISHER

Curator, Department of Astronomy, and of the Hayden Planetarium, American Museum

WHY did not somebody teach me the constellations, and make me at home in the starry heavens which are always overhead and which I don't half know to this day?"

There will soon be no excuse for those living in the metropolitan district of New York to utter this plaint of Carlyle's, for in spite of smoke, haze, clouds, and the glare of artificial lights, they will have opportunity to become familiar with the night sky, thanks to the new Hayden Planetarium which is coming to the American Museum of Natural History. This realistic representation of the sky is evidently more important to the city dweller than to the suburbanite, since the case of the former is further complicated by the fact that a great portion of the sky is hidden by the ever-present tall buildings.

Devices to show the movements of the planets and our moon in relation to the sun have been constructed since the early

days of Copernican astronomy, and no doubt previous to the announcement of the sun-centered theory of our solar system, there were devices to illustrate Ptolemy's earth-centered system. As early as the latter half of the Sixteenth Century, the great Dutch astronomer, Huygens, and the great Danish astronomer, Roemer, built a planetarium to represent the solar system, as it was then known, according to the new Copernican theory, and doubtless this invention had much to do with the general acceptance of the sun-centered notion of our family of worlds.

After the general acceptance of the Copernican theory of astronomy, a great variety of instruments was made for the purpose of showing the relative motions of the then known bodies in our solar system,—many of them crude, but for the most part very helpful. Some were limited to the earth and sun and moon, others just to the earth and the moon,



Champlain Studio, New York

MR. CHARLES HAYDEN

Through his generosity the marvelous planetarium instruments have been made available. In recognition of this the planetarium building at the American Museum is to be named in his honor

and still others to the sun and all the known planets and satellites.

One of the most interesting and complicated of these early instruments was built in England for Charles Boyle, the fourth Earl of Orrery, and this one gave us a new word for our dictionaries. The word "orrery" has come to be applied to this type of planetarium.

The most famous orrery or planetarium of this type to be made in America was devised and built by the "Father of American Astronomy," David Ritten-

house of Philadelphia. It is one of the most highly prized of the historical astronomical instruments in the Franklin Institute in Philadelphia, where it may now be seen.

Probably the largest, and certainly one of the best of these old-fashioned Copernican planetariums ever made is installed in the world-famous Deutsches Museum in Munich. Briefly it may be described as follows: A lighted globe in the center represents the sun. The six planets nearest the sun, with their satellites,—the planets and satellites all revolving at their proper relative speeds,—are represented. The diameter of Saturn's orbit is about thirty-five feet. Uranus and Neptune are left out because of the tremendous size of their orbits as compared with the four inner planets. Pluto had

not been discovered when the instrument was built, but its enormously larger orbit would all the more preclude the possibility of including it. There is no light during demonstrations except from the central sun; and the walls, ceiling, and floor are painted black. Consequently, the continual change from day to night and from night to day is well shown on all of the six planets, and so are the phases of our moon. For the lecturer or demonstrator, a small car travels around under the earth, which goes

around the sun in twelve minutes, the entire apparatus being propelled by an electric motor. By means of a wide-angled periscope, which makes it possible to see Venus and Mercury from the level of the plane of the ecliptic, the phases of these inner planets can easily be observed. The constellations of the zodiac are shown in a belt on the wall, with their names in white letters and with the degrees of celestial longitude marked. The principal stars of the zodiacal constellations are shown by lights back of small, round holes in the black wall.

In short, these planetariums or orreries consisted of a series of globes to represent the various bodies of our solar system, each revolving globe supported by a metal rod, the whole system of sun and planets and satellites being connected and propelled by gears so that their relative motions were approximated. Ever since

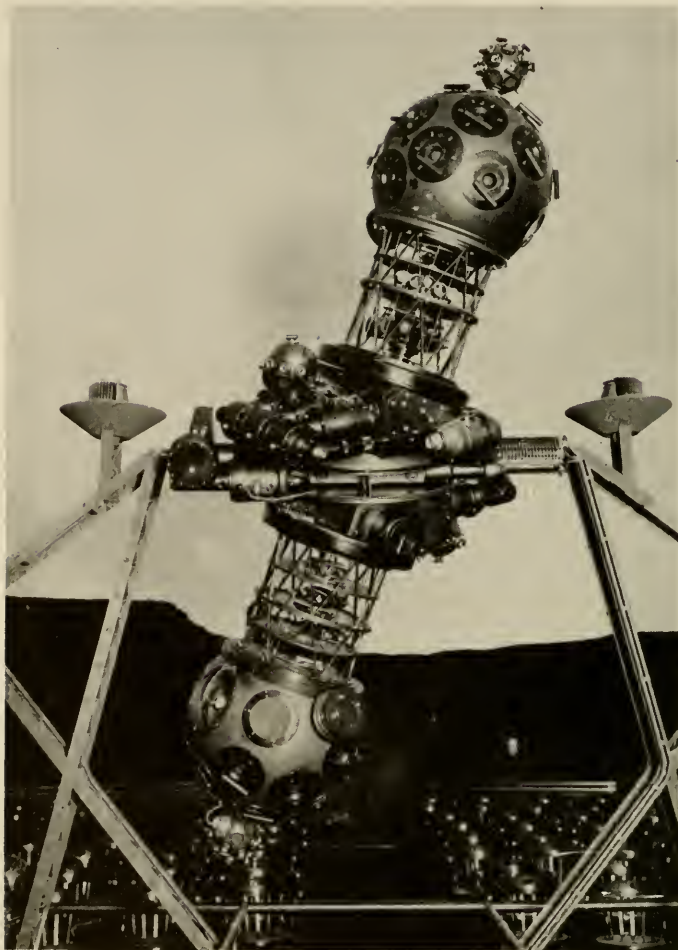
their first appearance, these devices have had and still have great value in teaching, the three-dimensional mechanism capable of simulating the motions of the heavenly bodies being incomparably more effective than flat pictures or pages of printed text.

In these mechanisms just described the observer is outside looking on,—a condition that has been improved by placing the model of the solar system inside a spherical glass globe, upon the outside of which is represented the constellations with their principal stars and also the Milky Way,—a transparent celestial sphere, certainly an improvement over the usual opaque celestial globe. Examples of this type are the “Astrophane,” made by Mr. O. J. Russert, and the small Copernican planetarium just inside the entrance to the Fels Planetarium, made by Max Sendtner of Munich.



THE HAYDEN PLANETARIUM

As it will appear from Eighty-first Street, New York City. From a sketch by Hugh Ferriss



THE PROJECTION APPARATUS OF THE ZEISS PLANETARIUM
An instrument more than a dozen feet high, built with the accuracy
of a watch

The next step in the evolution of the planetarium seems to be the model of the celestial sphere with the audience inside. This type has been developed in at least three different countries. In 1758 Roger Long, Lowndes Professor of Astronomy at Cambridge, built one at Pembroke College. The globe was eighteen feet in diameter and seated thirty persons. (Described in *A Cycle of Celestial Objects*, by Smyth and Chambers, pp. 208-209. Oxford, 1881). The only one of these that the writer has seen is in the Museum of the Chicago Academy of Sciences in

Lincoln Park, built before 1913 by Dr. W. W. Atwood, now president of Clark University. It is known as the Atwood Celestial Sphere. It consists of a hollow metal sphere in which the most conspicuous stars of the sky are shown by lights outside of small, round holes through the sphere. The small audience is seated inside the globe, while the latter revolves as the real sky seems to do. In all of these devices heretofore described, so many astronomical bodies and so many movements and relations have been omitted that they are evidently inadequate.

Late in 1924 there appeared something new under the sun, an apparatus that shows every object in the sky that is visible to the unaided eye, and in a most realistic manner. The rising and setting of the sun, moon, and stars are represented just as they occur

in nature, due to the rotation of the earth on its axis. The moon goes through its phases. The planets are shown as wanderers among the stars, their direct eastward and their retrograde westward motions being represented with great accuracy. Even the precession of the equinoxes, together with the swinging of the celestial pole around a circle, which in the sky takes 26,000 years, is shown by this apparatus.

In this new projection planetarium there are no globes to represent the heavenly bodies, and no holes through a

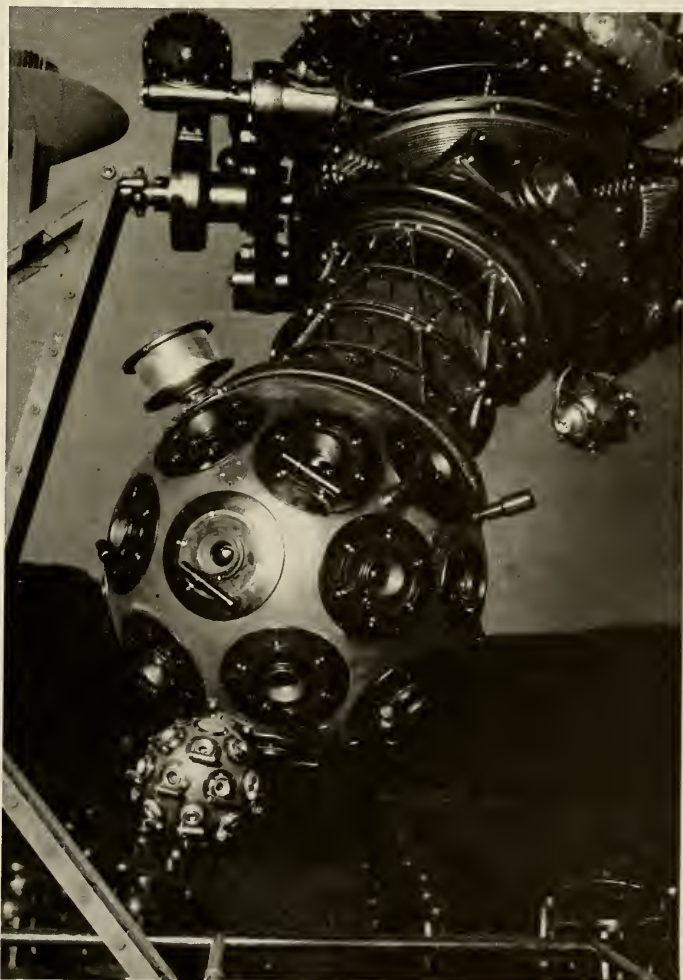
large globe with lights back of them, but everything is shown on the inside of a dome by projection of light from a central apparatus. The optimum size for this inverted bowl is from sixty-five to seventy-five feet in diameter. This hemispherical dome, which is white inside, becomes our artificial sky, and since there are no pillars or posts to intercept the light, the illusion of the depth of space is perfect. One feels that he has been suddenly transported outside under a clear night sky. The realistic appearance is beyond belief.

The projection apparatus, which is located on the floor in the center of the dome, is a bizarre-looking instrument some twelve feet high, resembling a huge dumb-bell with a long bar between the globular ends. The globes at either end of the instrument are for the projection of the fixed stars, one globe being for the northern and the other for the southern hemisphere of the sky. Each globe consists of sixteen stereopticons pointing in all directions with one central lamp. The lantern slides or diapositives are not square or rectangular, but are so shaped that their images fit together like the cells of a honey-comb, thus making a complete picture of the starry heavens without overlapping and without gaps.

The representation of the fixed stars, including the Milky Way, is a comparatively simple part of the performance of the instrument, and yet it is

certainly the most impressive. It matters not whether the audience be made up of children or adults, or professional people or laymen, the emotional experience is always the same. When the light is gradually diminished, bringing on the darkness of night in the dome, and the stars are "turned on," the audience gasps audibly in surprise at the breath-taking beauty of it. No one is prepared for anything so realistic and so dramatic.

Upon my visit to Jena in 1925,—made for the purpose of examining the first projection planetarium to be built,—when I congratulated the inventor, Dr.



NEAR VIEW OF A PROJECTION GLOBE
Showing the assemblage of stereopticons



THE OPTICAL POINTER

In reality a complete stereopticon with condensers and objective lens. An uncanny but most useful device

Ing. W. Bauersfeld, he admitted to me that the illusion of the immensity of space and the realistic representation of the fixed stars, including the Milky Way, had exceeded even his expectations. Due to some sub-conscious imagination, perhaps,—at least for some psychological or physiological reason, this artificial sky seems to possess the deep night blue seen in the real sky, and yet there is no blue color on the inside of the dome and none in the projection apparatus.

The names of the constellations may be shown on this artificial sky by means of a special set of projectors. The advantage of this over outdoor star-gazing in learning the constellations is obvious. With an optical pointer, or flashlight showing an arrow-shaped light, the lecturer can point out any star, planet, or other body in the sky. It is evident that an ordinary fish-pole pointer, even with a tiny light at the tip, would be precluded by the large size of the dome.

In the bar of the dumb-bell between

the globular assemblages of stereopticons showing the stars, are seven special projectors, one for each of the five planets visible to the unaided eye from the earth and one each for the sun and moon. From the standpoint of the inventor, these projectors which show the “wandering” of the planets including their periodical retrograde motion, the phases of the moon, etc., were the most difficult to perfect.

The whole apparatus has several different speeds, all of which are many times faster than the real motions. This makes it possible to condense a very long astronomical story into a very short time, and with increase rather than loss of drama, so that a child or a grown-up, who has not stopped learning, can get a clear understanding in a few minutes of the seemingly intricate though actually simple workings of the heavenly bodies.

With the projection planetarium, one can change his latitude at will. He can go to the Land of the Midnight Sun or to

the North Pole, and observe the apparent movements of the sun and moon and stars there; or he can go to the equator, or to southern latitudes and see the Magellanic Clouds, the nearest fixed star visible to the unaided eye, and the romantic Southern Cross.

With the projection planetarium one can go backward or forward in time. He can set the instrument back say 2000 years and note with accuracy the configuration of the planets among the stars at that time; or he can set it back 5000 years, say to 3000 B. C. when Alpha Draconis, the brightest star in the constellation, The Dragon, was our North Star; or he can set it forward say 12,000 years when Vega will be our North Star, and the Southern Cross will be visible from the latitude of New York.

Dr. Philip Fox, formerly professor of astronomy and director of the Dearborn Observatory at Northwestern University, brought the first Projection Planetarium to America and introduced it to our people. Thanks to the generosity of Mr. Max Adler, it has been established in Chicago in conjunction with the best astronomical museum in America, and Doctor Fox is director.

Made possible by the generosity of Mr. Samuel Fels, the second American projection planetarium has been installed in the Franklin Institute in Philadelphia, where it was opened last November. Mr. James Stokley,

formerly of Science Service, is the director.

The third American projection planetarium is soon to be installed in a building nearing completion in Griffith Park, Los Angeles. It now seems quite certain that New York City will have the fourth American projection planetarium. In the whole world there are now about a score of these remarkable instruments in operation, about a dozen in Germany, two in Italy, two in America, one in Austria, one in Sweden, and one in Russia.

Many of the greatest astronomers of the world have expressed in enthusiastic words their approval of this new device:



EXAMINING THE MECHANICAL EYELIDS

Which keep the stars from being projected on the audience or on the floor. How these boys would like to take them apart to see how they work!



A POPULAR ATTRACTION
Visitors waiting to enter the Adler Planetarium, Chicago

Dr. R. G. Aitken, director of the Lick Observatory,—“The Zeiss Planetarium is the most remarkable instrument that has ever been devised to exhibit impressively, and with the illusion of reality, the motions of the heavenly bodies and the phenomena which result from these motions.”

Dr. Walter S. Adams, director of the Mount Wilson Observatory,—“The Zeiss Planetarium . . . would prove of great educational value, fixing in the minds as no description could do the simple astronomical principles which everyone should know.”

Dr. Elis Strömgren, director of the Royal Danish Observatory in Copenhagen,—“Never was a medium of demonstration produced as instructive as this, never one more fascinating in effect, and certainly never one which appeals to everybody as this does. It is a school, theater, and film all in one, a lecture hall under the vault of the heavens, and a

drama in which the celestial bodies are the actors. No description, no photograph, no drawing can possibly reproduce the overwhelming impression made by a demonstration in a Zeiss Planetarium.”

The educational value of the projection planetarium is now widely recognized. In Italy the naval cadets are required to attend regularly the demonstrations at the Planetarium in Rome in order to acquire their navigational astronomy. In the Fels Planetarium in Philadelphia, besides the usual demonstrations with lectures to the general public, classes in astronomy from Swarthmore College come to the Planetarium once a week for special instruction by Dr. John H. Pitman, professor in charge, and this opportunity is being shared by students from Villanova College. Doctor Pitman says that the students get more astronomy in an hour in the Planetarium than in a week of lectures without its aid. Dr. Caroline E. Furness, profes-

sor of astronomy at Vassar College, in a congratulatory letter has written: "A planetarium will be of great benefit to me and my classes. . . . You may expect me to be a steady visitor when once the building is finished."

With Dr. Oskar von Miller, director emeritus of the Deutsches Museum in Munich, and with Mr. Waldemar Kaempffert, science editor of the *New York Times* and former director of the Museum of Science and Industry in Chicago, we believe that a combination of the Projection Planetarium and a large Copernican Planetarium, similar to the one in the Deutsches Museum, will make an ideal teaching unit, and in accordance with this belief we have planned to install both types of planetarium in our new building.

Dr. George Ellery Hale, dean of American astronomers, honorary director of Mt. Wilson Observatory, and member of our

Advisory Committee, in a congratulatory letter upon the assurance of our planetarium has made the following recommendation to the director of the American Museum: "I greatly hope its equipment will include a telescope of about twelve inches aperture, and such other instruments and exhibits as those under preparation for the new Planetarium and Public Observatory at Griffith Park, Los Angeles. In my opinion, based upon many years of experience at the Yerkes and Mt. Wilson Observatories, the public will not be contented with the Planetarium alone, but will wish for an opportunity to observe the sun, stars, and planets with a telescope and the necessary auxiliary instruments."

In the astronomical department of the Franklin Institute in Philadelphia, there are two fine, modern telescopes, a ten-inch refractor made by Carl Zeiss, and a



ENTHRALLED

Audience observing the representation of the night sky on the inside of the dome,—each heavenly body moving as it does in the real sky and with the time speeded up



METEOR CRATER IN ARIZONA

Four-fifths of a mile across and nearly 600 feet deep. Photographed by Clyde Fisher, January 12, 1933, when the ground was covered with snow. A photograph of Meteor Crater will be included among the astronomical transparencies to be installed on the walls of the planetarium building

twenty-four -inch reflector made by J. W. Fecker. These are mounted on the roof of the Franklin Institute building, quite a distance from the Planetarium, and they are in use on every clear night from seven-thirty to ten o'clock.

We are greatly pleased to announce in this connection a gift to the department of astronomy of the American Museum of Natural History, of an eight-inch equatorial telescope with Brashear object-glass. The telescope was manufactured by Warner and Swasey, who on three different occasions have made what was then the world's largest telescope, and it was used by the late Mr. Worcester Reed Warner in his private observatory at his home, Hillholm, at Tarrytown, New York. The gift of this valuable instrument is made by Mrs. Worcester Reed Warner as a memorial to Mr. Warner. It is especially fitting that we have in the

American Museum a memorial to Mr. Warner, because he was one of the only two honorary members of the Amateur Astronomers Association. It is to be regretted that the high surrounding buildings cut down the available sky so much that it is not practicable to install this telescope on the new planetarium building. However, it will be placed in a dome on top of the Akeley African Hall or on some other vantage point of the Museum buildings. It is evident that this telescope will be largely used by the people of New York City and vicinity, who are interested in seeing the real objects in the sky. This prophecy is based upon the long lines that have formed on the Museum grounds,—after the meetings of the Amateur Astronomers Association during the past seven years,—awaiting their turn at the portable telescopes lent by Mr. S. B. Grimson, Mr. George A. Galliver, Miss

Laura B. Garrett, Mr. C. W. Elmer, Mr. B. T. B. Hyde, Mr. James B. Wyber, Mr. Ramiro Quesada, and others.

In the planetarium building, besides the projection planetarium, which is obviously the chief attraction, and the large Copernican planetarium on the floor below, which will be immensely valuable in bridging the conception of the apparent and real motions of the heavenly bodies, there will be many accessory exhibits planned to make the whole astronomical hall a complete and well balanced institution for stirring the imagination and enlightening the mind.

Among these will be the great collection of meteorites belonging to the American Museum. This collection consists of several thousand specimens, representing a few hundred falls. Among them are three brought from Cape York, Greenland, by Peary,—one of these, the Ahnighito, weighing $36\frac{1}{2}$ tons, being the

largest meteorite in any museum in the world. There is also the famous Wilamette meteorite, weighing $15\frac{1}{2}$ tons, which fell near Portland, Oregon, and which has the unusual deep pits developed after its fall. Several specimens, one weighing a few hundred pounds, have come from the vicinity of Meteor Crater in Arizona.

In short, this is one of the most spectacular collections of meteorites in the world, and it will be installed on the main floor of the planetarium building just outside the Copernican planetarium. Up to the time when Kirchhoff made the principles of spectroscopy available, meteorites furnished our only direct and positive evidence of the constitution of any of the heavenly bodies outside of the earth.

Large transparencies made from the finest astronomical photographs in the world will be shown on the walls of the ambulatory around the Projection plane-



THE AHNIGHTO IN THE AMERICAN MUSEUM

This largest meteorite in any museum weighs $36\frac{1}{2}$ tons, and was brought from Greenland by Peary. It is planned to install the American Museum's collection of meteorites in the new planetarium building

tarium dome on the second floor, and on the walls of the first floor around the Copernican planetarium.

Sundials of several types, dial-rings, astrolabes, compasses, hour-glasses, replicas of Galileo's telescopes, and various instruments of historic interest in astronomy will be shown in well lighted cases.

A *cœlost*at, a spectroscope, and a spectroheliroscope, all functioning on clear days, so that the results can be observed by visitors, are included in the plans.

A Ptolemaic planetarium, three or four feet in diameter, illustrating the old earth-centered theory of astronomy, epicycles and all, enclosed in a spherical glass globe, with a crank that may be turned by visitors, is included.

A Foucault pendulum to show the rotation of the earth on its axis, and a vortex of water to illustrate the same phenomenon are contemplated.

The modern trend in the interest in astronomy will be shown, not only by transparencies from some of the newer photographs of spiral nebulae or galaxies, but also by a model of a galaxy, and a model to show something of what is known about the distribution of the nearer stars in our own Milky Way Galaxy.

All of the astronomical paintings by Mr. Howard Russell Butler, which are now shown in the Pro-Astronomic Hall, as Professor Henry Fairfield Osborn affectionately referred to it, will be re-installed in the new planetarium building. These include the famous tryptich of eclipses (1918, 1923, and 1925), and we hope to add Mr. Butler's fourth picture of a total eclipse of the sun, that of 1932. These are, without much doubt, the finest oil paintings of eclipses ever made. Perhaps as high praise could be given to Mr. Butler's two paintings of Mars, as well as to his other paintings in the hall.

On the outer wall surrounding the Copernican planetarium, on the first floor, there is planned a zonal oil painting representing the zodiac, that belt in the heavens in which the planets are found. This painting will show the mythological figures of the signs of the zodiac and the principal stars of the zodiacal constellations.

To greet the eyes of visitors as they first enter the building, there is under consideration a large decorative painting in oil, in three panels, illustrating American Indian astronomical mythology. Although primarily from the Blackfeet, the myths selected are those of rather wide distribution with little variation among the various tribes of North America. The left panel shows the Northern Lights or Aurora Borealis in the form of an arch in all the delicate colors, in which may be dimly seen the figures of the White Men of the North dancing around their campfires. The central panel shows the sun-god on a brilliant yellow background, the moon-goddess on a paler background, while in the upper right may be seen the Pleiades as conceived by the Indians, and in the upper left the Big Dipper and the North Star. These corner representations, with the Milky Way or Sky Trail between them, are shown in silver on a background of deep blue. In the lower left corner is represented the story of the creation of the earth by the Old Man. On the right panel is seen a symbolic Thunder-bird in the clouds with the conventionalized zigzag lightning striking from the cloud to the earth.

The planetarium building has been made possible by a loan from the Reconstruction Finance Corporation, while the instruments, both the projection planetarium and the Copernican planetarium, are the gift of Mr. Charles Hayden of New York City, for whose generosity a multitude of persons will be sincerely grateful.



MASK OF GREEN STONE,
TOTONAC (?) CULTURE,
NEAR TEAYO, VERA CRUZ

THE SCULPTURE OF PRE-COLUMBIAN CENTRAL AMERICA

The Second of a Series of Six Articles on the Major Artistic Accomplishments of
Central American Native Civilizations

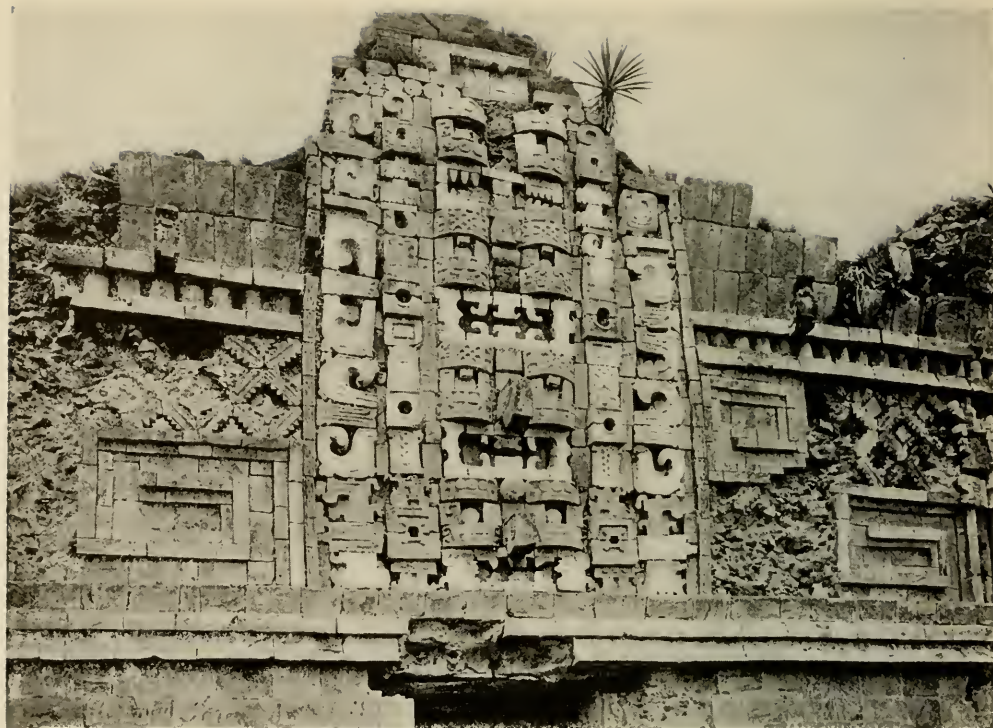
BY GEORGE C. VAILLANT

Associate Curator of Mexican Archaeology, American Museum

THE sculpture of Central America expresses in a more subtle and varied form the quality of impersonality noticeable in the architecture. The arts were created by nameless craftsmen to enrich their tribal ceremony, and were not expressions of the individual as they are today. Thus we see the Central American arts as a communal production, not the æsthetic reactions of a number of individual artists. Whereas the major buildings were the foci of the highly ceremonialized group religion, sculpture had a more diffuse function. Not only did it adorn the temples and explain their purpose, but also it depicted the god honored within the shrine. Plastic forms were also utilized in the creation of incense burners and other temple furniture. Sculpture had its place in the life of the individual, who fashioned from various substances his household gods and votive offerings. Again, images of people and animals were sometimes made to put into graves as equipment for the next world.

If the plastic arts of the Central Americans were not entirely religious, their inspiration, at least, must have originated in ritualistic necessity, to judge from the all-permeating effect of religion on tribal life.

This religious domination makes Central American art seem to us cold, unsympathetic, and confused. Accustomed as we are to completely untrammelled artistic forms and to the glorification of the individual, it is hard for us to conceive how an art could be so imprisoned by ritual. Yet if we think back to the slow emergence of European art from the formulæ of religious teaching, Central American sculpture becomes more conceivable. Its lack of emotional appeal is a question of racial interest. The Central Americans, to judge from their art, considered awe the proper emotional relation between the worshipper and his god. If European art had followed the Old Testament conceptions of religion instead of the New, the artistic forms of Europe and



"HOUSE OF THE
NUNS," AT UXMAL,
YUCATAN,
MEXICO

Late Maya period. Detail of the inner façade. Note the conventionalization of the superimposed serpent masks. Here religious symbolism has all but obscured the direct visual image, but there is complete mastery of design. After Holmes, 1915



CENTRAL VERA
CRUZ SCULPTURE

In this carving of a wild turkey, the requirements of design are met, although the presentation is naturalistic. To represent it more dramatically, the figure is shown base upward



TEMPLE
OF THE CHACMOOL,
CHICHEN ITZA,
YUCATAN

Period of Mexican influence. These pilaster figures represent a stage midway between the complete religious symbolism (page 260, upper) of the late Maya and the more naturalistic treatment of the Nahua peoples. After Morris, Charlot, and Morris, 1931



CLAY TIGER FROM
OAXACA, MEXICO

Zapotec culture. A tiger god is represented by this clay figure. The attributes of divinity detract little from the lively realism of the figure proper which has been humanized to some extent

Central America might have produced a very similar emotional effect.

Another conflict between the modern observer and ancient American art is the variation in the ethnic ideal of beauty. Consequently, it is well to remember that the Central Americans were reproducing their own racial type.

The confused quality of the art arises from two factors, the presentation of the attributes and symbols of the various gods and the extreme fascination which complicated design held for the Central American. After all, if we examined me-

dieval painting according to its original purpose instead of from our modern technical and æsthetic point of view, we would be infinitely bewildered trying to understand the attributes of the various individuals and the exact significance of the scene. Furthermore, simplicity or complexity in plastic design veers from one extreme to the other in the history of European art, so that Central American art cannot be justly dismissed by us on the ground of complexity alone. Therefore, if we discount our racial and emotional prejudices, aroused all too quickly by

the unfamiliar, we find in Central American sculpture a competent and versatile art, well adapted to the portrayal of human beings, as well as the relationship between them and their gods.

This sculpture is known to us chiefly by examples in stone and clay. Because of their perishability, few carvings in wood have been found, and shell, owing to its size, was used only for the making of ornaments. The carving of semi-precious stones like jade we shall defer to a later article on jewelry.

The earliest sculptures found are small figurines of clay. Their evolution can be traced fairly accurately through ascending stages wherein experiment and variety alternate with conventionalization arising from the attainment of temporarily satisfactory forms. The human form engaged the attention of these



GUERRERO, MEXICO

Unknown culture. This head of a monkey in black stone presents a happy balance between design and reproduction of a living form

early sculptors and there was a sustained effort to give the little figurines vitality by countless experiments in depicting the features. Owing to the difficulty of supporting strips of wet clay, arms and legs had to be disposed in more or less passive positions so that little action could ever be shown. Usually there is an underlying stylistic unity between the plastic product of each tribe, but occasionally individual expression obtrudes.

In the early culture groups clay sculpture was the dominating artistic medium, and, seemingly, the religion in those days must have been a simple anthropomorphism. With the rise of civilization the art was transformed to meet the requirements of religion, and the clay sculpture was no longer a dominant plastic medium. The development of a pantheon composed of different divinities atrophied the simple naturalism of the earlier art, and the invention of the clay mould made it possible to cast myriads of figures scrupulously defined by their attributes. Thus the craftsman tended to abandon this mechanical reproduction of divinities and utilize stone as a medium of expression, although he occasionally worked in clay with the most harmonious results. Conceivably, the increased specialization of individual activity in a developed civilization allowed men the opportunity to dedicate themselves to religious art, and



OAXACA, MEXICO

Zapotec culture. This clay figure in the Oaxaca Museum is a striking example of Central American art, when allowed to express itself without religious symbolism. Photograph by Miguel Covarrubias

to utilize materials like stone, which required time to shape.

We know on archaeological grounds that stone sculpture developed later than clay in the Maya and the Mexican regions. While it began like the clay plastic, in the round, it took a somewhat different course. Where clay could be readily shaped, stone had to be laboriously pecked and ground into the desired form. On the basis of the earliest stone carvings recovered from Central American sites, there seems to have been no inheritance



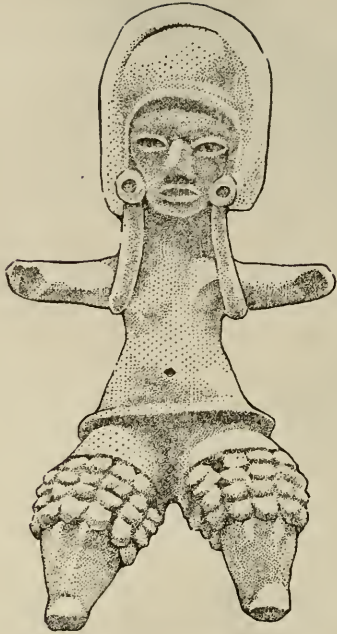
COPAN, HONDURAS

Early Maya culture. One of the best examples of Maya sculpture is this magnificent limestone head in the Peabody Museum. Compare it with the racial types shown on pages 259 and 263. This photograph and that on the opposite page are by Dr. Clarence Kennedy



COPAN, HONDURAS

Early Maya culture. This conventionalized serpent head, also in the Peabody Museum, expresses vividly the ceremonial preoccupation of the Central American sculptors, which all but extinguished their extraordinary naturalistic gifts, as exemplified on the opposite page



CUERNAVACA, MORELOS

Gualupita I culture. The genesis of the sculptor's art lay in the development of clay figurines like this in the Bourgeois collection in Mexico

from a former wood-carver's technique of which such strong traces exist in the sculpture of the archaic Greeks and ancient Egyptians. Wood-carving, on the contrary, appears to have followed in the path of the stone-work. Such a condition could well arise from the absence of adequate metal cutting tools, which so hampered the Central American sculptor.

It is perhaps owing to this circumstance that we note one of the most striking differences between Egypto-Grecian and Central American carving. The insistence in Old World art on anatomy would result from *hewing* out the rough outline of the figure, but the Central American preoccupation with external contour would arise from pecking and smoothing down the resistant stone surfaces. Probably the fleshy physical type of the Central American, in contrast to the

muscular and bony European, also contributed to this divergence in presentation.

Once the Central American sculptors had mastered their material sufficiently to fulfill their conceptions of gods, men, and animals, they began to develop the various applications of sculpture and also to establish regional styles. Even as in architecture, there is discernible the cleavage between the gentle Maya and the fierce Highland tribes like the Nahuas and the Zapotecs.

Maya sculpture in stone is chiefly to be found enriching buildings or composing those great monoliths on which the priests caused to be inscribed the ceremonial pattern of their calendar. But scarcely a specimen exists of complete sculpture in the round, such as might be enthroned on the central altar of a temple to symbolize a god.



CUERNAVACA, MORELOS

Gualupita II culture. This clay figure represents an advance over the crude work of the preceding period. It is but a short step from this figure to the skilful presentation on page 263

The most impressive sculpture comes from Copan, Honduras, where exquisitely carved figures ornamented an architecture that, compared to other Maya cities, was inferior. Great skill was shown in bringing out the soft outlines of human faces, and, in the depiction of bodies, real anatomical skill was displayed. Grotesque beings were conceived with equal imagination and artistry. The great stone blocks of the stelae or time markers also presented majestic figures, carved in such deep relief that only the back of the block, containing the inscription, disqualified them from being sculpture in the round. To the north at Quirigua this art reached its zenith in gigantic stelae, twenty-five feet high, and in those fantastic boulders, ornamented and reornamented into an essence of ceremonial involution.

To the west, across the lowlands of



PUEBLA, MEXICO

Unknown culture. This simple and vigorous presentation of a Highland face is characteristic of Nahua stonework. The eyes were probably inlaid with shell and obsidian



TEOTIHUACAN, MEXICO

Teotihuacan culture. This crude figure more than ten feet high represents an early stage in stone carving, which seems not to have been developed until long after modeling in clay

Guatemala, is another style of Maya sculpture, that of the cities of the Usumacintla River. Here, at Yaxchilan and Piedras Negras lintels of hard zapote wood or of limestone were adorned by scenes in low relief. Stelae, too, were decorated in the same manner, and, although some of the relief is very deep, nowhere does it approach sculpture in the round. The finest examples of this school come from downstream, at Palenque. So low is the relief and so firm the line, that the sculpture almost enters into the realm of drawing and painting. Especially interesting in this Usumacintla art is the naturalistic treatment of the figures which are framed by the hieroglyphic text.

To the north, in Yucatan, the sculptures are largely reduced to theological abstractions, wherein the gods are depicted by a harmonious disposal of their

SEIBAL,
PETEN DISTRICT,
GUATEMALA

Maya culture. This detail from a stone time-marker is a magnificent example of Maya low relief carving. Note the combination of naturalism in the figure proper with the pure design of the disposal of the headdress and the hieroglyphs. Especially graceful are the head-dress and the pendant plumes. After Maler 1908



VALLEY
OF MEXICO,
AZTEC CULTURE

This colossal head of the Goddess Coyolxauhqui in the Mexican National Museum is a masterpiece of Highland art. Compare the simple strength of this goddess, depicted as dead, with the softer elaboration of the Maya carving above



PIEDRAS NEGRAS,
PETEN DISTRICT,
GUATEMALA

Maya culture. One of the loveliest Maya treatments of life forms is this detail from a door lintel. Comparing it with the relief on the opposite page, one can see the difficulty in using modern European aesthetics to choose the best examples of an art based on totally different canons. Photograph by Dr. Clarence Kennedy



PANTALEON,
GUATEMALA

Pipil (?) culture. This detail from a massive carving seems to represent a blending of Maya artistic formulæ with the rugged strength of the Highland sculpture. Little is known of the ethnic affiliations of this distinctive school of stone carving



COSTA RICA

Guetar culture. This almost life-size stone figure comes from one of the cultures peripheral to the great Central American civilizations. It has a crude vigor, unobscured by the detail of religious symbolism

attributes. Such treatment precludes an appreciation of this carving as true sculpture, since it is, in reality, pure design. With the intrusion of the Mexicans and the rise of Chichen Itza, naturalistic reliefs again found favor, but they also had a strong theological flavor in their involved ornament.

Bordering on the Maya area to the south in Costa Rica and Nicaragua is a sculpture that represents a stylistic midpoint between the civilized conceptions of the Maya and the somewhat fumbling naturalism of the early cultures. Although probably contemporaneous with the best art of the Maya, it shows the archaism of provincial districts. There is, however, a rugged boldness about the major sculptures that establishes

them as highly significant forms.

The sculpture of the Mexican Highland at the outset seems to have fallen under rigid theological control. The sculptures at San Juan Teotihuacan and the grotesque divinities of the later Aztecs, reflect the elements of pure design arising from the theological use of form. Yet occasionally one finds superb naturalistic treatment of divine subjects. Nowhere on the Central Plateau does that balance obtain between the intrinsic beauty of natural forms and the harmonious design of theological conception obtain as in the Maya sculptures of Copan and the Usumacintla region. However, the art of this people freshly endowed with the paraphernalia of civilization, has an undoubted strength and vigor that one does not feel in the gradual unfolding of the older and softer Maya civilization.

This conflict in Aztec art between the grotesque conventionalization of religious dogma and the naturalism arising from increased skill in portraying human forms may be seen reduced to its essential constituents in the arts of the Zapotec and the Totonac. The Zapotec of Oaxaca practiced an extremely formalized art best exemplified in their clay funerary urns. In these specimens ritual is apparent in every line. Clay models were used to build up the ornaments and attributes of the divinities portrayed. Human or animal forms were used as a terrifying background for the addition of ceremonial features. Yet excellent naturalistic sculptures occur scattered infrequently through this art.

Among the Totonac of Vera Cruz we find the reverse, that the conventionalization of religious formulæ is subordinated to a rich portrayal of the human form.

Whenever conventionalization is deemed necessary, it is concentrated on some object like a ceremonial yoke, but it is nowhere used to throttle a naturalistic expression. Extremely entertaining are the clay "laughing heads," which grin with a blissful good humor. A number of the heads from the Totonac region were shown with oblique eyes, and created the belief in some quarters that this was Chinese influence. Since the American Indian is of Mongoloid stock, it is not surprising that such traits as the epicanthic fold should be reproduced in the sculpture, but it by no means implies that Chinese art had any connection with Central American.

From the point of view of the European, these east coast Mexican forms are the most satisfying of all the various Central American sculptures, since there is a minimum of theological grotesqueness. Closely connected with this Totonac art is that of the Huastecs at the north of



TEMPORAL, VERA CRUZ, MEXICO
Huastec culture. This seated female figure is a survival of the most primitive art in clay

Vera Cruz. Although Maya-speaking, their sculpture shows no artistic influence from the parent stock and is noteworthy in its appreciation of youth.

An exquisite group of sculptures comes from a strip of territory that runs from coast to coast between the lands of the Aztecs and the Zapotecs. Conjecture might attribute these marvellous carvings to the Olmec, who appear in the dim background of mythological history. It is a perplexing paradox that the creators of the beautiful heads and ornaments from this area, which were traded far and wide, must rest in anonymity, unless further research can define them. Much of the sculpture belongs to the lapidary's art.

Another important style of sculpture comes from the Pacific slopes of Guatemala and expresses a fusion of Nahua vigor and Maya mastery of ritualistic design. This plastic style suggests a sudden genesis, rather than the slow evolution of a self-contained tribal art.

Finally, the rich clay plastic of Western Mexico gives us an idea of the utmost



GUIAROO, OAXACA, MEXICO
Zapotec (?) culture. The rugged racial type of the Mexican Highlands is shown vividly by this small stone head

development of a people who were subjected neither to the discipline of complicated ritual nor to the stimulation of a highly organized religion. While there is great variety in subject and attitudes, the characteristic one would expect from an art in the hands of the people, there is none of the finish of the Central American arts under hierarchical control. If these western Mexican sculptures are basically religious and intended for use as mortuary offerings, they are nevertheless worked out by lay methods. They are in reality survivals of an older æsthetic system.

However unified the purpose of Central American sculpture, it is not the product of a single people and should not be so considered. It is the product of a number of tribal groups, of different language and physical types, striving to glorify their religion, according to their various abilities. Yet there is, none the less, a generic resemblance in the sculpture as a

whole, which lies in the absence of those sensual and emotional features that characterize our own. It is not to be expected that people of one race can derive from the art of another the same psychological reaction, particularly if it is religious. However, the detached and impersonal repose of the Central American sculptures has a soothing effect in this modern era where intensely independent individuals strive to perpetuate their personalities in the face of mass production. While there is conflict in Central American sculptures between the freedom necessary for naturalism and the conventionalization dictated by theology, it is a struggle of technique. The creators of the sculptures were harmonizing

their tribal life with the rhythms of nature. They expressed their gratitude for divine favors through the skilled anonymity of their

craftsmen, and their works registered complete content without a sign of the fickle protest in our modern art.



QUIRIGUA, GUATEMALA. MAYA CULTURE. THIS STELE OR TIME-MARKER IS SOME 25 FEET HIGH AND SHOWS THE CEREMONIAL ART OF THE MAYA AT ITS BEST AFTER MAUDSLAY, 1889-1902



WESTERN MEXICO. THESE CLAY FIGURES EXEMPLIFY THE VITALITY AND HUMOR OF A FOLK ART UNAFFECTED BY REQUIREMENTS OF RITUAL



The Laysan Albatross

WANDERERS OF THE SEAS

Albatrosses, Birds of the Stormy Waters of the Southern Hemisphere,
which Nest on Coral and Volcanic Rocks in the Pacific Ocean

By ALFRED M. BAILEY

The Chicago Academy of Sciences

PHOTOGRAPHS BY THE AUTHOR

CORAL isles in tropical seas and ice-worn rocks of the Antarctic are the homes of the wide-ranging albatrosses. The birds spend a few weeks upon their nesting islands, carry on their courtships, hatch their young, and then depart again for the open spaces of the rolling ocean. It is unfortunate that the *Ancient Mariner* could not have recorded that, with his camera, he shot the albatross, for then he could have had a pleasant recollection of his experiences with the long-winged sea birds.

The wandering albatrosses are creatures of the stormy waters of the Southern Hemisphere, but the name "wandering" could be applied equally to other species, for they are all wide ranging, working the open ocean for hundreds of miles from their nesting islands. The albatrosses of

the Pacific, north of the equator, nest on coral and volcanic rocks in mid-ocean, ideal homes for animals which range the far-reaching leagues of the sea.

It was my good fortune to spend a season in the haunts of the albatrosses, voluntarily marooned with three companions far from the line of travel. Our little island, Laysan, in the Leeward chain, which extends northward some twelve hundred miles from the Hawaiian group, was a bird paradise, where the albatrosses and other rangers of the ocean came to rear their young. Our bird neighbors were unafraid of man, so we had ample opportunity to become acquainted with them. We visited their colonies on stormy days, when the waves pounded over the coral ledges with grumbling roars, their breaking crests white against the sullen



**A COLONY OF LAYSAN
ALBATROSSES**

Nesting along the salt lagoon. Birds off duty would gather in groups to wile the time away



**A BLACK-FOOTED
MADONNA**

Squatted proudly beside her offspring. The fuzzy youngsters of this species are the color of coral sand

○



THE BLACK-FOOTED ALBATROSSES

Nesting on the exposed
beaches. When on-shore
winds blew, the waves often
destroyed their nests

©

A PUGNACIOUS PARENT ON GUARD

The blackfeet would stand no
foolishness from the camera
man, and often charged with
snapping beaks





THE EXPEDITION'S ISLAND HOME

A few rambling shacks, a watch tower, and two coconut palms were the conspicuous marks of the little island

sky, and found the brooding birds crouched low upon their nests, all facing into the wind; again, when all was clear and the sea was still, the reefs would be exposed for miles out in the glistening blue of the Pacific, and the albatrosses would be sitting high upon their eggs, while visiting neighbors, temporarily off duty, were apparently passing the time of day.

There were two species in our little sanctuary,—the beautiful white Laysan albatrosses which nested along the gentle slopes and the flat that bordered the salt

lagoon in the center of the island, and the more aggressive black-footed albatrosses which preferred the wind-swept and wave-pounded beaches as proper surroundings for their offspring. Both places had their disadvantages, for the high seas often rolled over the nests upon the beaches, while heavy rains raised the waters in the salt lagoon and inundated those in the near vicinity. The birds were persistent under adverse conditions, and it was a common sight to see an old one sitting on her egg when the water was almost deep enough to float her away. The birds would pull soil and vegetation about them, building their mud nests higher, but hundreds of eggs were destroyed. The bristle-thighed curlew swarmed on to the flats and ate the abandoned eggs.

The albatrosses had just started housekeeping

when we arrived late in December, for there were less than one thousand nests; it was not long, however, before thousands of others had deposited the single egg and, while incubation was going on, scooped a little embankment to form a nest.

These birds are affectionate during the nesting season, and when one desired to take its turn upon the egg, it would approach its mate, they would rub cheeks together, caressing, and talking in gentle tones. Usually, the one upon the nest was reluctant to leave, and it was necessary for the other to shove it gently

away. Then, when it had possession of the precious egg, the bird would tuck it under her carefully, talking to it like a mother to a new-born babe.

While incubation was going on, the bird "off shift" was usually ranging the ocean for food, the squid being the principal article of diet. But there were always birds standing around, more or less idle, and these whiled the hours away by dancing, a performance which probably originated as a courtship affair but which has degenerated into a shindig that is carried on for pleasure only. The dance usually started by one old fellow waddling to a neighbor, waving his head and snapping his bill, and, if the other felt inclined—the dance was on. They would bow to each other, talking and groaning; one would reach around as though taking something from under his wing and hand it to his partner who would accept it with a bow, and then one would throw his head in the air with beak pointing straight upward, and give a hoarse cry. The birds were usually rather leisurely in their dance, but when four or more would get together they would become so excited that there was no order to the performance, and one or two would waddle off in disgust. They were usually so interested in their dance that I could approach within a few feet of them, but when they finally observed me, they would paddle away like

children caught in mischief. They dance all night long, and it is a weird sight to see ghostlike figures flitting in the moonlight, and to hear their strange calls combining with other night voices.

The first egg hatched (after an incubating period of thirty-one days) January 21, and we found the black-footed parent squatted at one side of the nest, surveying her youngster with evident pride. And what a change came over the mild-mannered "black feet" as soon as the eggs began to hatch. They would stand



AMONG THE BONES OF HIS ANCESTORS

Japanese poachers raided Laysan and killed thousands of birds. This little Laysan albatross had a nest lined with the remains of former dwellers of the portulaca-grown flats



AMONG THE NESTING ALBATROSSES

The white albatrosses showed a great deal of curiosity, and often, when their human visitors sat motionless, they would gather around and tug gently at a bit of clothing



ON WITH THE DANCE

Albatrosses dance at all hours of the day and night, a performance which probably originated in a courtship affair, but which is now apparently carried on for pleasure



GETTING ACQUAINTED WITH A BLACKFOOT

The black albatrosses were not pugnacious until after the eggs began to hatch, and did not seem to resent familiarities



PERSISTENCE

The mud rims about the nests served a useful purpose when the heavy rains raised the waters of the lagoon. Thousands of nests were destroyed, however



A DESERT WASTE

Laysan was formerly clothed with luxurious vegetation, but rabbits were introduced and the grasses were destroyed. A few clumps still persisted, in spite of the drifting sands

no foolishness from a camera man, and would attack the intruder, snapping their great, razor-sharp beaks,—most excellent weapons which discouraged one from approaching too near. The Laysan albatrosses were of a more gentle disposition and did not resent our presence, however, as did their dark cousins.

The little fellows began to snap their bills like the adults, almost before they were able to sit upright; they are droll creatures which show their unfriendliness by patting their soft beaks together, but

they quickly become accustomed to man. There was one fuzzy little pirate whose nest was made of bones of departed albatrosses, and this one and its parents were particularly incensed when we wandered near. We started making friends by stroking the young one, and it was not long before he would raise himself as high as possible, with wings extended, and remain in that position as long as we would accommodate him.

Twenty-five thousand Laysan albatrosses nested along portulaca-covered flats of the salt lagoon,—a snow field of white breasts glistening in the tropic light. What wonderful creatures they are when flying! They swoop and bank with scarcely a movement of their large wings, but as agile and graceful as they are, they are so numerous that collisions are inevitable. Occasionally they come together head

on, and they drop to the earth with a resounding thump, only to shuffle away awkwardly, as though ashamed of having been caught in a traffic jam. With their heavy bodies and long wings, it is necessary for them to run against the wind in order to take off, and occasionally I would keep several birds walking ahead of me down wind for several hundred yards. When they grew tired of strolling with me, they would sprint down wind with wings extended, knocking over all adults and babies in their way, and then,

turning into the wind, would make the sand fly as they tried to get into the air. Just a touch on the wing would upset them, and then they would try again.

There were sixteen thousand of the black-footed albatrosses on Laysan, according to our estimate. We marked the island into quarters and each of us counted nests; we allowed a percentage for non-breeding birds, and so, we believe, secured a fair idea of the number of both species.

There are many other isolated rocks, sandy keys, and coral atolls making up

the chain of bird-breeding islands in that bit of tropical ocean, where the birds go each year to rear their young. They spend three months on land, possibly, where we can become acquainted with them, if we desire to visit such remote places, but then they depart again for the open ocean, where we can observe them from a distance only. For nine months, at least, they are creatures free to roam at will with nothing but their fancies to guide them; —they are just wanderers of the seas.



ON STORMY DAYS THE WAVES POUNDED ON THE CORAL LEDGES WITH GRUMBLING ROARS, THEIR CRESTS WHITE AGAINST THE GRAY OF THE SKY



Courtesy of L. P. Schultz

A Sturgeon about Thirteen Feet Long, Supposedly Taken on the Siberian Coast

THE LARGEST FRESH-WATER FISHES

The Giant Sturgeons of the World

By E. W. GUDGER

Bibliographer and Associate in Ichthyology, American Museum of Natural History

PERHAPS the question most frequently directed at the department of fishes in the American Museum pertains to the sizes attained by fishes. To the question, "What is the largest fish?" the answer is "Either the whale shark, *Rhineodon typus*; or the basking shark, *Cetorhinus maximus*—probably the former." The whale shark has been measured to 45 feet and estimated by experienced persons to attain 60 or 70 feet. For the basking shark no compilation of sizes has ever been made, although it is said to grow to 36 and 40 feet. Some day I am going to collect the data for the lengths of these two great sharks and by comparing them determine which is the larger.

But my questioner comes back at me thus: "Many thanks, but these are both marine fishes. Now please tell me what is the largest fresh-water fish?"

To this I answer that there are four great fresh-water fishes: the alligator gar, *Lepidosteus spatula*, of the Mississippi River basin; the pirarucu, the *Arapaima*

gigas, of the Amazon and Orinoco basins; the giant catfish, *Silurus glanis*, of the Danube; and the giant sturgeon, *Acipenser huso*, of the Black and Caspian seas and of the rivers that flow into them. Then I add that, so far as I know, no one has ever ascertained the greatest lengths to which they attain, but that the great beluga is said to attain a weight of 2760 pounds and even of 3200 pounds and a length of 24 feet.

But again my questioner—"But we have great sturgeons in our own United States. How do they compare with the Eurasian forms? How large do they grow? Are they *our* largest fresh-water fishes?"

Having the data at hand for some of these questions, I shall try to answer them by giving figures and reproducing photographs.

Some years ago I learned that very large sturgeons were sometimes taken in the Fraser River, and in the Columbia River and its lower tributaries. An effort was made to secure data, but nothing came of it. However, more recently, in-

teresting photographs and accounts have come to me through the kindness of Professor Leonard P. Schultz of the department of fisheries of the University of Washington. These form the basis of this article, and for the reliability of the reporters Professor Schultz vouches, since he knows them personally.

The giant of our Pacific sturgeons is *Acipenser transmontanus*, the transmontane, white, Oregon, or Sacramento sturgeon, found on the Pacific coast of North America from Monterey, California, to Alaska. Of it Jordan, Evermann, and Clark say in their *Check List of the Fishes . . . of North and Middle America* (U. S. Bureau of Fisheries, Washington, D. C., 1930), "Largest of the [American] sturgeons, reaching a weight of 1000 pounds. A record specimen, taken at Astoria [Washington] weighed 1900 pounds." Then they add: "Once abundant, now nearly extinct."

I have sought in vain to ascertain the authority for these statements. Clark, the only surviving author of the trio, can give no authority nor can any of my correspondents in Seattle and elsewhere. However, as a result of my inquiries, some interesting photographs and data for very large specimens have come to hand.

The first of these large fish is shown in the figure on page 284 made from a photograph sent me by Professor Schultz. He states that the fish was taken at the mouth of the Fraser River, British Columbia, and that it measured 10 feet 6 inches in length, and weighed 1015 pounds. It is indeed a magnificent specimen.

Professor Schultz has also sent me records of another and longer but lighter fish caught in the same locality in May, 1931. This was a female measuring 12 feet in length. Just out of the water it weighed 800 pounds, but its dressed or net weight was only 692 pounds. It contained 50 pounds of eggs which were made into caviar.

Mr. L. J. Farley, Prosser, Washington, is seen in the figure on page 285, standing beside his great sturgeon taken from the mouth of the Yakima River, an affluent of the Columbia at the point where, after flowing south, it turns west to the Pacific. The fish was 11 feet 6 inches long over all, but weighed only 826 pounds. It was caught on a set line baited with lamprey eel. Mr. Farley states that it was a specimen of the green sturgeon (*Acipenser acutirostris*) but this may be an error. He had heard of a 12-footer weighing about 1100 pounds taken from the Yakima some years before.

The next set of data comes from Mr. A. B. Chapman of Seattle, Washington. He sends me a photograph of an 11.5-foot specimen taken in 1917 from the Columbia River at Kalama, Washington, close to its mouth. It was a female weighing 835 pounds and was of the same length as the preceding fish but slightly heavier. From it were obtained ninety pounds of eggs which sold for \$1 a pound. The total value to the fisherman of this sturgeon was about \$150. The photograph, an old picture postcard, which shows this fish lying on the ground, is not suitable for reproduction.

The largest of all the Columbia sturgeons reported to me was taken near Vancouver, Washington, about 125 miles from the mouth of the great river. I owe the data to Mr. Wilbert M. Chapman, a graduate student in the department of fisheries, University of Washington, Seattle. The fish was captured late in May or early in June, 1912, in a salmon gill-net in which it was rolled up after the fashion of a netted shark. This giant was 12.5 feet long and weighed 1285 pounds. It was a female and had roe weighing 125 pounds. Curiously enough, this was also the weight of its huge head.

Mr. Chapman had these data from his father, Mr. A. B. Chapman, who had the fish photographed, made the measure-



Courtesy of L. P. Schultz

THE WHITE STURGEON OF THE
FRASER RIVER

This huge specimen measured 10 feet 6 inches "over all" and weighed 1015 pounds. While it was 2 feet short of the record for the Pacific Northwest, it was only 270 pounds lighter

ments, and then dressed it. He states that this was the largest specimen he ever saw taken from the lower Columbia during all the time that big sturgeon were being captured there.

This is the record fish from the Pacific Northwest, and indeed for the United States, for which we have definite data, and it is greatly to be regretted that no figure can be shown. Mr. Chapman writes that the photograph has unfortunately been packed away and that he has not been able to locate it. He adds that the day of these immense sturgeons in the lower Columbia is over, and that one has to go to the region around the mouth of the Snake River for them now—but these only weigh around 500 pounds. The largest he ever saw there weighed "a little over 300 pounds." "The average sturgeon [in the lower river] now weighs about 25 pounds, and big ones about 100 pounds." How are the mighty fallen!

I have stated that the above 12.5-foot, 1285-pound sturgeon is the largest from the Columbia River of which there is definite record. However, there is a legend that in 1892 a sturgeon weighing more than 2000 pounds was caught near Astoria, preserved, mounted, and exhibited at the World's Fair at Chicago, in 1893. Possibly this is the fish referred to by Jordan, Evermann, and Clark. I have been unable to ascertain anything further about this great fish, though every effort has been made to run down its history.

It has probably been noted by the reader that the two 11.5-foot fishes were lighter than the 10.5-foot specimen. The sex of the latter was not noted but the two former were females. The 11.5-foot fishes may have been spent or unripe females or males—which sex in fishes generally runs lighter than the female.

Among the materials kindly sent me by Doctor Schultz was the photograph of the fish shown on page 282. This is

labelled "Giant Sturgeon Supposed To Have Been Taken Off the Siberian Coast." This is probably correct if one may judge by the physiognomy and dress of the fishermen standing behind it. Unfortunately there is no history of this photograph.

It is greatly to be regretted that no measurements are given, but, judging by the size of the men, the larger specimen must be 12 or 13 feet long. The smaller appears to be about 7 feet over all. But the larger, while less than twice as long as the smaller, looks as though it might weigh three to four times as much—and probably at least 100 pounds to the foot of length. The genus and species are not given, but by comparing the photograph with the figures of sturgeons in Berg's *Freshwater Fishes of Russia [including Siberia]* it would seem to be *Huso (Acipenser) huso*. This great fish, if not longer than Mr. Chapman's Columbia River specimen, appears bulkier and heavier than any of the American sturgeons figured.

For the magnificent fish portrayed on page 286, I am indebted to Mr. Ferdinand Hansen, president of the Romanoff Caviar Company of New York City. Mr. Hansen states that this huge fish was caught in his presence at the mouth of the Volga River near Astrakan, Russia, in 1912. Its length was 14 feet 2 inches, its depth 2 feet, and its weight 2250 pounds. "It became entangled" says Mr. Hansen, "in one of the huge drifting nets used in the Caspian Sea, and was practically undamaged when brought to shore." Mr. Hansen thinks that such a great fish would contain about 100 pounds of roe, but this is probably an underestimate.

This fish, like that from Siberia, is a *Huso huso*, and this particular specimen is, I believe, the largest on record. This is said notwithstanding the fact that J. S. Kingsley in his *Standard Natural History* (Boston, 1885, Vol. III, p. 93) says that "The huso of the rivers falling into the



Keystone View Company

GREAT STURGEON FROM THE
COLUMBIA RIVER

Mr. L. J. Farley beside his big 11½-foot fish. It weighed only 826 pounds, was one foot shorter than the American record, and 459 pounds lighter.

Compare with the fish on the opposite page

Black and Caspian Seas, . . . sometimes reaches a length of twenty or twenty-five feet, and a weight of nearly three thousand pounds." Nor do I believe the *Cambridge Natural History* (1904, Vol. VII) when it says of the *Huso* that "individuals weighing 2760 and 3200 pounds have been captured." Nor do I take any stock in the *Encyclopaedia Britannica* (1911, Vol. XXV) when it says that the hausen (*Huso huso*) "attains the enormous length of 24 feet and a weight of 2000 pounds." Nor can I swallow David Starr Jordan's fish (*Fishes*, 1925) which "ranges in length to 30 feet." And I do not even believe the Father of Ichthyology, Pierre Belon,

who in his book on fishes (the first on that subject ever published in the history of the world—1551), says that a sturgeon 18 "pieds" long was once brought to King Francis. None of these writers gives reference to those who have seen and measured these fish. These accounts are just old tales, copied by one man from another. I quote the late Dr. F. A. Lucas that: "All fishes shrink under the tape," and, it may be added, on the scales.

Finally, let it be said that, so far as the facts and figures at hand enable one to say, the giant beluga of the Volga and Caspian is the largest fresh-water fish. And Mr. Hansen's specimen is the largest for which we have reliable data.



Courtesy of Ferdinand Hansen

A GIANT BELUGA STURGEON FROM THE VOLGA RIVER

This fish measured 14 feet 2 inches long, was 2 feet deep, and weighed 2250 pounds



Photograph by Le Roy Davies

Bear Mountain Trailside Museum Approach. Geology Building in Foreground

TRAILSIDE UNNATURAL HISTORY

"Tales That Are Strange and Amazing"

By WILLIAM H. CARR

Assistant Curator, Department of Education, American Museum

WE were standing beside the new snake pit near the Bear Mountain Trailside Museum, watching a beautiful, glistening mountain blacksnake swim gracefully around the island in the middle of the enclosure. A large crowd lined the circular railing, admiring the performance.

"He really is handsome," said one woman grudgingly.

"That's the snake that kills rattlers," volunteered an onlooker.

We knew at once that another snake fable was to be added to the long list that had come to us over a period of years. We listened attentively as our guest went on:

"You see the blacksnake chases rattlers through the woods, comes up behind them, and then they have a battle. The blacksnake always wins!"

"What happens if the rattler bites the blacksnake?" asked his credulous companion.

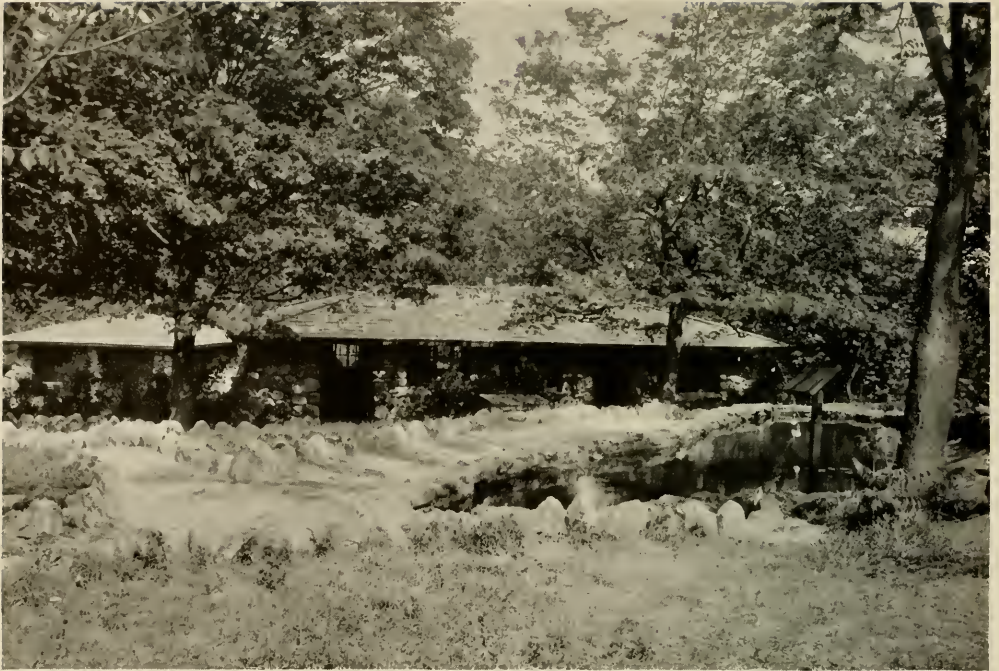
"Oh, they take care of that. If the rattler bites the blacksnake, he goes off

and chews a certain kind of weed and comes back to finish the fight. Every time the rattlesnake bites him, he goes off and chews the weed and keeps right on until the rattler is dead!"

And the strange thing is that people really believe these things! Time and time again we have heard persons tell far-fetched stories and claim actually to have witnessed the utterly fantastic actions described. Folk lore is a fascinating subject—one that has provided us with background material for many exhibits, indoors and out, along the Nature Trails and in the Trailside Museum.

Among the many new features added to our Nature Trail area this season, the snake pit was perhaps the most successful as far as large crowds and popular interest were concerned. Numerous fact and fiction stories were heard at the pit-side.

We heard the familiar "hoop snake" story on literally countless occasions—the story of the mythical snake that grasps its tail in its mouth and, à la bicycle tire.



Photograph by Le Roy Davies

TRAILSIDE CRAFTHOUSE

This workshop served visitors in many ways. Children and adults were encouraged to use tools and materials to build natural history collecting equipment

rolls merrily down the hill, or across the plains, as the case may be. This odd serpent was frequently reputed to "strike at trees with his tail"; whether in a fit of anger, or a spirit of revolt against local conservation policies, the story tellers never related. In any event, the trees so attacked would invariably die! We would be only too glad to secure one of these snakes, if one but existed. In fact, we would cheerfully construct a saucer-shaped bowl, similar to the ones used in six-day bicycle races, that the reptile might be properly exhibited in action.

Seriously, these stories are rather sad. Snakes have too many human enemies as it is. It is an absolutely senseless thing to kill harmless snakes, and the fables circulated actually do a great deal of harm. Persons are unnecessarily frightened and then fail to grasp the fact that the snake is one of the most interesting animals upon the face of the earth.

Our trail labels try in their own way to correct certain points of mis-information. Here are several samples:

One cannot determine a rattle-snake's age by the number of rattles on its tail. Frequently many individual rattles are lost as the snake travels about and, again, rattle-snakes often "grow" more than one rattle each year

Snakes do not have "stingers." They bite with fangs, or with teeth. Only poisonous snakes have fangs.

There is no truth in the story that all snakes are harmful. Many are decidedly beneficial and should not be killed. By what authority do you kill snakes?

A great naturalist once told us that his only objection to the Bible, as a book, was the "Adam and Eve" story. He said sadly:

"The whole thing was so unfair to the snake!"

There are animals other than snakes that have been grossly maligned in popular imagination. We have been annoyed to hear the tales related by visitors in regard to the habits of fish, birds, mammals, and almost every other type of creature that flies, crawls, creeps, or swims.

The fallacy in regard to hawks and owls is of truly serious consequence and one that has a very real bearing upon our native woodland. Careful scientific investigation over a period of years in many parts of the country has revealed that many of our so-called "birds of prey" are decidedly beneficial and should by no means be slaughtered indiscrimin-

ately. It is true that there will always be a certain amount of willful killing, but a great deal of good may be accomplished through public education.

Our Trailside efforts have ever leaned heavily toward the side of plant and animal conservation. We have discovered that it is useless to rant about the extermination of animals of various sorts. However, we have been able, through carefully planned methods, to correct many false impressions and to stimulate respect for creatures that were formerly considered "vermin."

What a vicious word is "vermin"! It is applied frequently to any animal that displeases gamekeepers, or provides a good target for otherwise useless guns. A short time ago a large, expensive automobile drove into our parking space. The liveried chauffeur jumped out, opened the door, and helped an immaculate gentleman to come forth. The chauffeur



Photograph by Le Roy Davies

THE SNAKE PIT

Trailside employees heard many "nature fables" here. The island of stone, surrounded by water and ringed with an inverted, circular wall, served to confine the various harmless snakes on exhibit



Photograph by Le Roy Davies

SNAKE SHELTER

A large, hollow tree shelter was provided upon the snake island. Here several blacksnakes are shown moving into the sunshine

then returned to the car and brought out a box. We expected at least a ruby for our Geology Museum, or a rare animal (for which we would have had no use) for our Zoo.

On opening the box with proper ceremony, we saw a lifeless, red-shouldered hawk, lying upon carefully arranged tissue paper. The gentleman was beaming, with a "cat that swallowed the canary" smile, evidently expecting us to exclaim with joy.

"See what I've brought you," he said. "We shot him near the stables this morning. He was flying low over the fields, looking for chickens."

"Do you keep chickens on your place?" we asked.

"No," he answered, "but he was looking for them, just the same!"

Our donor seemed just the least bit crestfallen. He had looked for a more lively evidence of appreciation on our



Photograph by Kenneth Lewis

THE BARRED OWL POSES

The immature owl proved a great attraction. Persons who observed him carefully learned that "owls do see in the daytime." The bird has grown considerably during the past winter



Photograph by Wilfred Miller

NATURE TRAIL INTERLUDE

The Swamp Trail runs through shaded woodland, across Hessian Brook, and on to the Trailside Museum. Many labels tell stories of plant life along the way

part. We thanked him and invited him to our office, where a large chart showed the results of many stomach examinations of numerous specimens of hawks and owls.

In a moment we explained that the red-shouldered hawk, which he had called a "chicken hawk," was in reality a bird that should be protected, rather than warred against.

"He must have been looking for mice over the fields," said the chauffeur helpfully.

"The red-shouldered hawk and many of their relations eat enormous quantities of harmful mice each year," confirmed the chart mutely.

"Well," said the man, "I guess we shouldn't kill hawks. The farmers in our region shoot every hawk they see. I'll try to tell them about it. When one discovers a hawk in the act of killing a chicken, though, I suppose he should be killed?"



Photograph by M. Peter Keene

TWO SMALL TURTLES

Howard Cleveland is seeking turtle information at first hand. It is the function of Trailside to provide opportunities of this sort



GERALD

Mr. Hugh Spencer, a visiting naturalist from Chester, Connecticut, made this portrait of Gerald, the young opossum. Many photographic opportunities are offered to the owners of cameras

"Yes," we replied, "he might be killed with good reason. However, that should be no reason for killing all hawks. Some acquire bad habits, but these are probably in the minority."

We walked out of doors over to "Colonel's" cage. "Colonel" was a fine young barred owl, with black eyes and banded feathers.

"I've heard that owls can't see in the daytime," said our guest.

"Colonel" turned his head and gazed off over the treetops. A prominent sign in front of his cage read:

Owls do see in the daytime

"I see," said the man, unnecessarily!

"Do owls knock you down at night and chew your ears?" queried the chauffeur. His expression was perfectly serious.

"Where on earth did you ever hear that one?" we asked, amazed.

"Why, down home in Pennsylvania, we were always told that owls liked to eat people's ears!"

Sensing a "goblin'll git you if you don't watch out" story, we conscientiously explained that, as far as we knew, owls were far more interested in avoiding people than in attacking them. We also said that we had never heard of owls showing any special preference for thin human ears instead of for fat mice!

"That may be," said the gentleman, "but a friend of mine was once

attacked by a large, brown owl that had tufts, like ears, on the side of its head. He was trying to secure the owl's young ones at the time."

"The great horned owl will certainly attack when its young are disturbed," we replied. "But that has nothing to do with ears! No doubt your friend will think twice before tackling a proposition of that sort again!"

We wandered over to the cage containing an opossum, the strange marsupial that carries its young in its pouch.

"Ah, ha, a 'possum!" beamed the hawk-bearer.

An old man leaned against the guard rail, peering short-sightedly at the sleep-

ing animal. Opossums, by the way, are rather unsatisfactory to exhibit. They persist in sleeping all day and in waking up at night, when all the visitors have gone home!

"I don't like 'possums," stated the old man. "They're tricky things. They steal the laces out of your shoes to build nests with!"

"Is that a fact?" asked our other guest.

It was evident that he was willing to believe anything whatsoever, provided it related to beasts with which he was unfamiliar. The chances are that he himself would be very keen where business matters were concerned.

"Did you ever see an opossum in the act of stealing shoe strings?" we asked the old man.

"No, I never did," he replied, "but down south they all say its true!"

"Did you ever see an opossum's nest made of shoe strings?" we asked further.

Again the answer was "No."

"Oh, it's a regular habit with them!" continued the old man.

"It's a wonder they don't steal the shoes, too, and be done with it," said the chauffeur.

"They probably would," the old fellow rambled on, "but you see they don't like leather!"

Our guest leaned over and whispered, "I'm afraid that chap is simply romancing."

We agreed with him emphatically and moved on, before any other pro-

ducts of an over-productive brain were forthcoming.

The hawk-shooter rode off shortly with, we hoped, a few natural history ideas in his head—ideas that had to do with truth and fiction.

Among hosts of other visitors were many young men from near-by Civilian Conservation Corps Camps. These boys, gathered from wide-spread sections of the country, were sadly in need of forest instruction during the first few weeks of their encampment. However, the camps were excellently managed, and soon regular, detailed periods of education were instituted by an all-beneficent government. At first we went out to the camps



Photograph by John Rothwell

TAME RED-SHOULDERED HAWK

It is worth while to keep at least one hawk in captivity each year in the Educational Zoo. Labels tell of reasons for hawk conservation

frequently, to lecture and to invite the personnel to visit us. Here was an excellent opportunity to encourage people to use their leisure time intelligently. There seemed to us no better way for these boys to use their spare time than to familiarize themselves with the natural objects of their new environment, with the trees and flowers, the birds, and the animals.

Here was a rare chance for us to gain some first-hand information as to natural history fables. We were told that the raccoon of the south traveled about all winter, because its "bones were too large for its skin," and "this always made it restless"! Needless to say, this was as much of a falsehood as another story we heard that the muskrat, when alarmed, "could stand on its tail upon the water," the better to scan the surrounding country!

We also heard that there was a "snow snake" that slept all summer and emerged only on the coldest winter days to travel

about upon icy surfaces. This snake, so it was claimed, had a special growth or appendage upon its tail shaped somewhat like a powder puff, which was used to smooth a path in the snow, to permit unobstructed locomotion. Apparently this fabulous serpent journeyed backward!

And then there was the one about the bullfrog that "always swam upside-down, because there was more weight on its back." Another bullfrog tale related how large groups of the unhappy amphibians invariably "croaked before a thunderstorm, so that the warm air in their lungs would cause the lightning to strike elsewhere!" One searches in vain for some spark of truth in these stories. Alas, the truth is not there!

One may readily understand that the Civilian Conservation Corps proved a fertile field for natural history teaching. It goes without saying that many of the boys were well-founded in woods-lore, but not all!



LIGHTNING DID NOT STRIKE HERE!

This young frog was not the one that "croaked before a thunderstorm," at least as a regular practice. Above, on this page, will be found a strange frog tale

On one occasion a group of these boys in their blue dungarees visited our Trailside Museum in a highly excited frame of mind. It appeared that, on their long walk over, one of the young men had, by exercising great stealth and no small amount of courage, captured a dangerous creature of some sort beneath a rock at a brookside. The animal in question was safely contained in a tin tobacco can.

"It's a lizard!" announced one boy. "It tried to hook its fangs into me, but I shoved it into the can with a stick!"

As we opened the lid on the can, we were cautioned to "Look out, he might jump!"

We peered in and there lay a perfectly innocent, inoffensive, spotted salamander—one of the most harmless of all the defenseless creatures to be found in our native woods.

We struggled to explain that the small animal had no fangs and was an amphibian, closely related to frogs and toads, not a "lizard" at all!

As we reflect upon it, there is nothing particularly humorous about all of this. It is rather sad that persons who live in the out-of-doors and who frequently travel in the woods, and those who spend their vacation in the open are so abysmally ignorant of the most common, ordinary, every-day "facts of life," as it were. If our Trailside Museum and Nature Trails can in any way succeed in making even the smallest of impressions



Photograph by Wilfred Miller

COCO, THE RACCOON

This raccoon's bones do not appear to be "too large for its skin." In fact, Coco ate so heartily that her bones were not in evidence!

in the correction of popular misconceptions, well and good. The important thing is that proper information and conservation go hand in hand. Vituperative letters to the newspapers accomplish very little. Earnest, conscientious efforts to inform are of much value.

"That beats me," said the salamander capturer, "I was always told that these things were lizards."

"Yes," we replied, "we once knew a fisherman who thought the same thing. He killed every salamander that he saw. It took us a long time to convince him that he was in error."

"You mean to say that we shouldn't kill these things!" exclaimed the boy.

"Certainly not!" we answered. "You have absolutely no right whatever to go about through the woods destroying *anything*! This is a State Park. It belongs to the people, not to you fellows alone and, besides, whether it is a State Park or not, you still would have no right!"

"I see that you preach a bit over here, too," laughed an older man, who had played the part of eavesdropper.

"Well, they asked for it!" we replied.

We had very little hope that our advice would serve as a deterrent to these particular C. C. C. boys. Yet there was certainly no harm in trying. About all that we are able to do is to insert a wedge and then endeavor to drive it home. What more may anyone do!

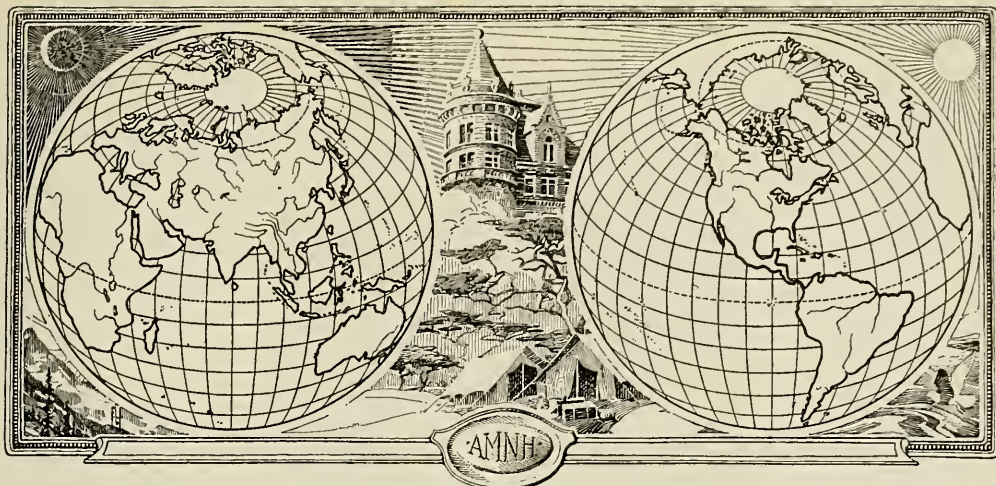
What is responsible for widespread

popular misinformation concerning an endless diversity of plants and animals? There are, among many others, three main reasons. The first has to do with an inherent lack of interest; the second, with the inability to observe accurately; and the third, with the deplorable practice of elders giving wrong information to children, instead of saying, "I don't know," and then honestly seeking to aid the child in his quest for knowledge.

It is the most natural thing imaginable for children to have a wholesome interest in the world about them. That interest should be encouraged in every sane way. In years to come, it is to be hoped that the only animal fables to be discovered will be contained in books. It is fairly safe to say, however, that no living man will ever see that day!



A SUN-FLECKED TRAIL



SCIENCE IN FIELD AND LABORATORY

Expeditions—American Museum Activities—Education—
Meetings of Societies—New Publications

EDITED BY A. KATHERINE BERGER

EXPEDITIONS

THE AMERICAN MUSEUM-SINCLAIR EXPEDITION.—An airplane survey for dinosaur remains among the jagged hills of the Big Horn Bad Lands forms an important part of a fossil hunt to be made this summer in the West by the American Museum of Natural History under the leadership of Mr. Barnum Brown, curator of fossil reptiles.

This expedition is made possible through the generosity of Mr. Harry Sinclair, financier and oil operator. It will be known as the American Museum-Sinclair Expedition, and its principal purpose—aside from making an aerial survey of fossil regions in Wyoming, South Dakota, and Montana—will be to excavate two skeletons of prehistoric giants which probably belong to a hitherto unknown species of dinosaurs; they were found in 1932 and partly uncovered in 1933.

Mr. Brown expects the expedition to get under way in June. He will be accompanied by Messrs. P. C. Kaisen of the Museum staff, G. E. Lewis of Yale University, and Darwin Harbiet of Montana.

Expedition headquarters will be established by Mr. Brown at Cloverly Post Office some twenty-five miles northeast of Graybull, Wyoming. This site has been selected because it is close to the spot where the two Sauropods of heretofore unknown species rest in a "grave" that is 65 feet long and 45 feet wide. The skeletons will be removed by excavating the matrix of rock in which they are embedded and sent to the Museum.

ASTRONOMY

DURING the month of May the season of the Amateur Astronomers' Association draws to an end. The last two lectures of the year are on Wednesday, May 2, when Mr. Joseph L. Richey of the American Telephone and Telegraph Company speaks on "Astronomical Factors and Radio"; and on Wednesday, May 16, at which time there will be a showing of astronomical motion pictures, and the Annual Meeting of the Association. All persons interested are most cordially invited to attend these meetings.

During May, also, the series of radio talks given by the Association over Station WOR comes to an end. These talks are given on Wednesday afternoons from 5:15 to 5:30:

May 2—Dr. Clyde Fisher—"The Calendar."

May 9—Mr. Ramiro Quesada—"Amateur Telescope Making."

May 16—Mr. Charles A. Federer, Jr.,—"Star Clouds."

May 23—Mr. Hugh S. Rice—"Summer Telescopic Objects."

MANY requests have come to the astronomy department for information concerning the hours and lectures of the Adler and the Fels Planetariums. The Adler Planetarium in Chicago has a very fine astronomical museum which is open on Monday, Wednesday, Thursday, and Saturday, from 10:00 A.M. to 5:00 P.M.; on Tuesday and Friday from 10:00 A.M. to 9:00 P.M., and on Sunday from 2:00 P.M. to 5:00 P.M. Planetarium demonstrations with lectures are given on Monday, Wednesday, Thursday, and Saturday at 11:00 A.M. and 3:00 P.M.; on Tuesday and Friday at 11:00 A.M. and 3:00 and 8:00 P.M.; and

on Sunday at 3:00 and 4:00 P.M. The Fels Planetarium of the Franklin Institute in Philadelphia has lectures as follows: Monday, Tuesday, Wednesday, Thursday, and Friday at 3:00 P.M. and 8:30 P.M.; Saturday at 11:00 A.M., 2:30, 3:30, 4:30, 8:30 P.M.; Sunday at 2:30, 3:30, 4:30 and 8:30 P.M. During May the subject of the lecture at the Fels Planetarium is "The Skies in the Year 14,000: Precession." During June the subject is "The Midnight Sun."

A CAMERA DEMONSTRATION BY NATURE.—On August 31, 1932, Mr. F. S. Gehr, while in the northern part of New York State, witnessed "a camera demonstration by nature," as he calls it, during the memorable eclipse of the sun which occurred on that day. He succeeded in making photographic records of the demonstration, one of which is reproduced on this page, together with his account of his experience:

Astronomy was in its glory for the day, and men from all over the world were established in position to get pictures of the display in the heavens. Being a photographer myself, I had a camera set up to get as good a record of it as possible, but, like so many others, I failed to get what I expected.

A friend of mine, Mr. Becker, was standing beside me when I took the shot of the eclipse, and just as I had finished, he shouted to me to look at the cabin. Always in fear of fire when in the woods during dry times, I was startled and wheeled for a quick look, expecting almost anything. I swept the front and roof of the cabin in one glance, but failed to see any signs of the fire demon at work. That one quick glance not only assured me that the cabin was not on fire, but it also made me gasp.

While thousands of people were watching the sight in the skies they were missing the massive camera effect that was being displayed wherever the proper set-up was at hand. I was at one of those locations, the set-up being made possible by the work of nature and of man.

The part of the camera lens was being played by openings through the leaves of the trees, and the front of the cabin took the place of the ground glass or film. The cabin front was almost covered with crescents the exact shape of the eclipse. I just stood and took in the view to the limit of my eyesight, which at that time seemed to be more than active. Suddenly I happened to think of my camera, and at once reset it for a picture of the cabin. By that time the light was so dim that I was afraid I would not be able to fully reproduce the display before me. I waited until the eclipse was starting in the last half, then, with a color filter over the lens of the camera, I made an exposure. Removing the filter, I made two other exposures, but when these negatives were developed, I found that the one in which I had used the filter, produced a better negative.

CONSERVATION

BIALOWIES THE OLD AND NEW HOME OF THE EUROPEAN BISON.—In the late summer of 1931 Dr. W. Reid Blair, director of the

New York Zoological Park, was delegated by the New York Zoological Society to visit various localities in Europe where specimens of the wisent, or European bison, were still to be found, for the purpose of making a general survey of the situation and formulating plans which would ultimately lead to the rehabilitation of the remnants of this ancient and interesting species.

The census figures for several years past had indicated that the total number of wisents still in existence had been reduced to a figure representing almost the vanishing point for the species. It was therefore hoped that if measures were taken

at this time to provide for a natural increase in the numbers of the wisent, the species might be saved from complete extinction and gradually reestablished as an important part of the fauna of Europe.

With this purpose in mind, Doctor Blair inspected first the herd belonging to His Grace, the Duke of Bedford of Woburn Abbey, who owns the largest herd of pure-blood European bison in existence. Proceeding to the continent, Doctor Blair, accompanied by Dr. and Mrs. Kurt Priemel, president and secretary respectively of the International Society for the Preservation of the Wisent, saw the collections of wisents at the Hagenbeck Tierpark near Hamburg, in the Zoological Gardens at Berlin, Hannover, Breslau, Dresden, and Frankfurt-on-the-Main, and at the Government Station at Springe. In Germany a visit was also made to the estate of the late Count Arnim-Boitzenburg, owner of the largest wisent herd in Europe.

The tour further included an inspection of the herd belonging to the Prince of Pless located in the 25,000 acre forest preserve at Katawice in



NATURE PHOTOGRAPHS THE ECLIPSE
A photograph taken by Mr. F. S. Gehr during the eclipse of August 31, 1932

what was formerly Upper Silesia, and a visit to the collection in the magnificent forest of Bialowies. The tour of inspection was made by automobile under the auspices of the Polish Ministry of Agriculture in the company of Mr. von Janta-Polczynski, Doctor Hausbrand, and Forest Supervisor Biernacki, representing the Minister of Agriculture.

As a result of Doctor Blair's observations and report, the New York Zoological Society agreed to subscribe the sum of \$15,000 covering a period of five years, in furtherance of the plan promulgated for the establishment of parks or reserves where nucleus herds of pure-blood wisents will be introduced for propagation along scientific and systematic lines. One tentative site has been selected in Bavaria for the proposed operations and the animals will be acquired either by gift or by purchase from the funds donated by the New York Zoological Society. A small international committee selected by the European Bison Society is administering these funds.

Some idea of the manner in which the \$15,000 subscribed by the New York Zoological Society is being expended, may be gained from the following description of Bialowies, the old and the new home of the European bison, recently received from Miss Erna Mohr, Archivar, International Society for the Preservation of the Wisent:

Before the war about 800 wisents lived in the primeval forest of Bialowies, under the care of the Czar of Russia. The war reached this animal Eldorado, swept over it, and the herd was wiped out. On February 9, 1921, the last wisent in natural surroundings became the victim of a poacher's bullet. The fate of all wisents, not only in Bialowies but elsewhere, seemed sealed.

In 1923, after years of effort the International Society for the Preservation of the Wisent (Office: Zoo, Frankfurt, a.M.) was founded. This society includes all breeders, owners, and friends of the wisent, and in time from the scanty remnants a new wisent race was bred.

In the meantime the heath of Bialowies became a part of Poland, and the wisent question became a national problem. The Poles wish to give the wisent a new home in old surroundings and, therefore, have bought up all the stock available. Although not all the animals were of pure breed, some had traces of the American bison and of the white cattle of the Podolian steppes,—the Polish government was not discouraged. The bastard bulls were placed in many Polish Zoos as "Phenotypes," while the pure breeds and the bastard cows were quartered in the Bialowies reservation.

In July, 1933, the Polish government gave me an opportunity to visit Bialowies and view the animals, a number of which had been familiar to me before their removal to Poland.

Bialowies is a large reserve which gives the impression of being a collection of primitive huts, and a few stone houses. The buildings within the gates of the park, however, are well-built and comfortable. Bialowies is situated on the Narewka River and is at the end of the railroad, which branches off at Haynowka into the primeval forest. A museum, with many zoological collections, the administration office, and the rooms for government guests are located in the former hunting seat (a castle) of the Czar.

Between Grodno and Brest Litowsk the heath of Bialowies covers an area of 500 square miles, 130,000 hecto, of which 37 hecto are fenced off as wisent reservation near the highway between Bialowies and Haynowka. It consists of several enclosures of various dimensions, the largest, with heavy underbrush and high fern growths, being inhabited by a part of the herd. The leader and master of this herd is the bull "Borusse," born in the park of Count Arnim of Boitzenburg in Uckermark. Three heifers and a

pregnant cow, separated from the rest for protection, were in another enclosure. In the third very large one lives the bull "Hagen," twenty-two years of age, born in the Hagenbeck Zoo at Stellingen in 1911. This bull leads a quiet life save from the temper of Borusse, of whose strength and force of horns the fence shows traces. All animals have choice of light and sun, or coolness and shade, or sand or grass. A firm wooden trough near the fence contains water and additional food. In the summertime this food is usually refused, as the enclosures are so large that all necessary nourishment can be found in the open. On the other hand, the animals depend entirely on the water which is drawn by a keeper from a well between the enclosures. This seepage water is the only available water. By eliminating pools and stagnant water, it is hoped that the animals will be spared from becoming infested with the liver fluke, that scourge of game and sheep, which claimed so many victims in Bialowies in former times.

With the exception of the bull-leader, all animals are remarkably good-natured. This is of advantage only as long as they are kept within the enclosure, and will be lost as soon as they are liberated in the primeval forest. At the present time, the autumn of 1933, the Bialowies herd consists of six pure breeds and as many valuable bastards. Only the pure bred stock will be liberated later on.

All visitors who wish to see the herd are taken to high wooden platforms from which they can safely overlook the reservation. As a rule strangers are not permitted to enter the enclosures, first, for self-protection, and second, to prevent contagion for the animals.

The Zubr Reservation is not the only object of interest for sight-seers in Bialowies. The Primeval Forest Reservation perhaps is of still greater interest. The entrance to this is about one kilometer from the park. A vast area is completely enclosed. Here not a shot, not a blow of the axe is heard. Fallen trees remain as they fell. Only those which block the narrow driveway are rolled aside while those that fall on the trails remain. Again and again one must jump and climb over them. Leaf trees alternate with conifers. Oaks 600 years old and 38 meters high, elms 400 years old and 37 meters high, firs 200 years old and 46 meters high, delight the nature-lover. Besides these, one finds ash trees 400 years old and 37 meters high, and linden trees 300 years old and 42 meters high as forest trees, a fact entirely unfamiliar to us. The hornbeam also (*Carpinus betulus*) is of gigantic growth. Birds are abundant; big game includes roe, deer, and wild boars; in the winter-time a few wolves come near. Later on, the pure-breed wisents will be liberated here as the last and greatest dedication to this natural park. The surroundings are so magnificent that one can almost become reconciled,—in memory completely—to the enormous swarms of buzzing and chirping insects, which cannot be worse in the notorious northern summer.

Thousands of foreigners from all countries visit Bialowies every year. When I was there, nine different tongues were being spoken. In several tourist houses, lodgings and provisions can be obtained, and a casino provides for those of modest demands. Indeed, new Poland has founded something unique for Europe in this achievement, and her contemporaries should be very grateful.

THE WOOD BISON, PLAINS BISON, AND PRONGHORN ANTELOPE IN AMERICA.—Dr. Hugh M. Raup in a recent paper on the wood bison brought together some valuable information on its history in Wood Buffalo Park in Western Canada. The northern bison apparently suffered an immense decrease in numbers during approximately the same period as its southern relatives. Figures relating to the former abundance and decline of this animal to near extinction are very limited. In 1893 the Canadian Government enacted the first laws for protection of the wood bison and in later years created a national park covering most of its present range. With efficient protection, the numbers of wood bison probably now reach well into thousands.

Early white travelers who entered the basin of Athabaska and Great Slave Lakes found bison as well as other game abundant. Mackenzie, on his epoch-making journey to the mouth of the river



PRONGHORNS IN
NORTHWESTERN NEVADA
Antelope herd at a water hole on
the Charles Sheldon Wild Life
Refuge, a sanctuary area of 30,000
acres

named for him, noted large herds of bison along the Slave River. Later, in 1793, on his trip to the Pacific Coast, he found that the plains on either side of the lower Peace River, near the mouth of Smoky, abounded with bison. Early records and statistics indicate that wood bison ranged at least over most of the upper half of the Mackenzie basin between the Rocky Mountains and the Slave River, north, roughly, to the Horn Mountains. According to accounts of early travelers, they were seen in great numbers in the region immediately west of the Slave River. The present site of Fort Smith maintained the remnant herds longer than any other district and may have been the center of abundance, though there is no definite account of this prior to the period of reduced numbers. Seton figures the forested bison range area as about 1,000,000 square miles, which supported no more than about 5,000,000 head.

The wood bison reached its lowest ebb some time in the late 1880's or early 1890's, and owes its preservation up to that time to the isolation and remoteness of the country in which it existed. It was not until 1772 with the settlement of the country and increase in the fur trade that danger threatened to reduce its numbers. Factors concerning the rate and manner of approach to near extermination are not well known. It seems to have persisted in its wide range in fair numbers until after 1840, and from then on until 1870 the decrease was gradual. The destruction during the short period between 1870 and 1890 appears to have been rapid. It was difficult to determine with reasonable accuracy the number of buffalo in the region in question at that time, owing to the nature of the country. Various estimates of the total number were made

during this period. The most reliable ranged from 150 to 600 head, but some even set the figure as low as fifty. The law for protection of bison that was passed in 1893 was not rigorously enforced until 1897, but in later years, under police protection, a steady increase in numbers was assured, and in 1922, when the Wood Buffalo Park was established, the number was estimated at 1500.

It should be noted that in the Park there are now two separate main groups of bison—the northern herds which are considered typical wood bison, and the Peace River herds, which, according to some authorities, have interbred with the plains bison, and it is to the southern herd that the surplus from the Wainwright Park is being added from time to time. A census of bison in the Wood Buffalo Park in 1929 showed that there are 10,000 head in the two groups, it being impossible to make a distinction between them.

The typical wood buffalo as a pure race is probably disappearing. The northern herd may yet be intact, but the rapidly increasing southern herds may soon cover the whole area and in consequence interbreeding will be inevitable.

The American Bison Society has more or less brought up to date the present status of the plains bison. A summary of the bison census taken in 1929 shows that there are approximately 18,494 pure blood bison in the world today. Of this number 3,385 are in the United States; 14,969 in Canada, including the wood bison; 21 in Alaska; 4 in Mexico; and 115 in South America and other countries.

Though formerly the bison range covered some 3,000,000 square miles, reaching from the Atlantic Ocean to Oregon and from Great Slave Lake to the Gulf of Mexico, the center of abundance for the plains bison was the great plains lying between the Rocky Mountains and the Mississippi. Early explorers give us no more definite record of its numbers than "countless herds," "teeming myriads," etc., but Seton states that we are safe in placing the number of bison formerly living on the entire plains as about 40,000,000. The range on the prairies was a third as large as that on the plains, but the prairies were more fertile and

probably sustained a population of 30,000,000. The total number of bison on the plains and prairies was about 70,000,000 for an average year.

As a result of the recent action of the National Association of Audubon Societies the Charles Sheldon Wild Life Refuge has been established for antelope, an area of 48 square miles or 30,720 acres. The antelope on this refuge seem to vary from 500 to possibly 2,000 individuals, depending on the season the observations are made.

The pronghorn antelope diminished greatly in numbers at about the same time as the bison and probably through very much the same cause. It is difficult to obtain anything like an accurate census of the numbers of antelope in the widely scattered herds ranging over such vast areas. In 1908 the Biological Survey estimated the number to be less than 20,000 for the United States and Canada. About this time the pronghorn had probably reached its lowest ebb in numbers although the census made by the American Bison Society in 1921 recorded but 11,279 head for the same area. Doctor Nelson, in his 1922-24 census for the Biological Survey, with the coöperation of various agencies, concluded that there were 26,604 in the United States and 1327 in Canada during that period. Today, a fairly accurate census of the pronghorn published in the *Bulletin of the New York Zoological Society*, (November, December, 1932) places the figure at 68,392 in the United States, and 2400 in Canada. While Doctor Blair considers that these figures are possibly somewhat optimistic, the fact of greatest interest is that the pronghorn is increasing in numbers and the future bears a certain assurance for their safety.

The efforts of the American Bison Society, the Boone and Crockett Club, the New York Zoological Society, and other institutions also have done much to incite public sentiment and provide funds to preserve and perpetuate the game animals of North America.—G. G. G.

EDUCATION

BEAR MOUNTAIN TRAILSIDE MUSEUMS AND NATURE TRAILS.—For the first time since its inception in 1927 the Bear Mountain Nature

Trail was maintained throughout the year. The new Crafthouse and Geology Museum also remained open during the winter months. This institution, supported jointly by the Commissioners of the Palisades Interstate Park and the American Museum of Natural History, will officially open its eighth spring season on May first, at which time the following educational features will be in operation:

Main Nature Trail
Geology Trail
Botanical Trail
Swamp Trail
Acorn (question and answer) Trail

Historical Trail
Trailside Museum
Trailside Geology Museum
Trailside Crafthouse
Snake Pit, etc.

A Trailside Historical Museum and Library, now under construction, will be a new feature for the year. It will house the Hyde Memorial Library and will be the largest of all the Trailside units. It is expected that this Museum will be open to the public in mid-August.

The new buildings of this and last year have been erected near the West Gate Toll House of the Bear Mountain Bridge. They occupy grounds never included in the Nature Trail System and, therefore, do not, in any way, encroach upon the trail area. The small, stone, out-of-door museums serve as concentration points where students and the general public may crystallize information gained along the trails.

THE department of visual instruction of the National Education Association will hold its annual meeting on July 2d and 3d in Washington, D. C. The program which is being arranged by the president, Mrs. Grace Fisher Ramsey, associate curator of education in the American Museum, will consider the two themes: "Visual Instruction in the Modern School" and "The Social Aspects of Visual Instruction."



YOUNG WISENTS IN THE
BIALOWIES SANCTUARY,
POLAND

In this magnificent forest a nucleus herd of pure blood wisents has been introduced for propagation

Demonstrations of teaching techniques and discussions by well-known sociologists promise a program of paramount interest to educators and also to those who merely desire to keep abreast of modern trends in education.

THE American Museum of Natural History has been offering in its department of education a free course of four informal talks on Jade and the Drummond Collection, by Mr. Herbert P. Whitlock, curator of minerals and gems. The lectures, two of which have already been given on April 21 and 28, are on Saturday afternoons at four o'clock. The remaining two lectures occur on May 5 and 12, and will include the Section of Modern Jade and the Section on Amber and Ivory, respectively, of the celebrated Drummond Collection.

FOSSIL VERTEBRATES

ON the evening of March 15, Mr. Barnum Brown, substituting for Prof. Henry Fairfield Osborn, lectured at the American Museum, giving an account of the expeditions for dinosaurs during the past four years in Wyoming, Montana, and South Dakota. This series of expeditions has resulted in the acquisition by the Museum of sixteen skeletons and partial skeletons of Lower Cretaceous dinosaurs representing new species, genera, and at least one new family—filling in a gap in its fossil fauna between the Jurassic and the close of the Cretaceous.

At the close of the lecture Mr. Brown demonstrated with charts the subdivision of the geologic periods with their duration in years, and demonstrated with samples of radio-active materials the emanations and dispersal of radio atoms made audible by the Geiger Counter, an instrument constructed by and loaned for the occasion by the General Electric Company of Schenectady. The following simple explanation of the Geiger Counter is given by Mr. L. A. Hawkins of the General Electric Company:

The Geiger Counter consists of an ionization chamber, amplifier, and a loud speaker. Emanations from the radio-active substances penetrate a thin diaphragm, enter the ionization chamber and cause a momentary flow of current through the chamber. This impulse is amplified and passed into the loud speaker. It is thus evident that for each penetration of the ionization chamber, there will be a click of the loud speaker.

For the disintegration of each atom of radio-active substances, there is an emanation. Since the ionization chamber does not surround the whole mass of radio-active substance, it intercepts only a definite portion of the total emanations. By counting the number of loud speaker clicks over a given period of time, the rate of disintegration is determined. By weighing the uranium, for example, we determine the total number of atoms present in the piece. This total number in the case of uranium includes several other types of atoms of the various stages of disintegration, the last stage being lead. By chemical analyses the proportion of lead, and, therefore, the total number of lead atoms is determined. This number combined with the rate of disintegration, as determined by the Geiger Counter, enables one to determine the age of the particular sample.

I have not gone into great detail in connection with the case of uranium because the substances intermediate between uranium and lead have different rates of disintegra-

tion, and, furthermore, the emanations are of three types, alpha, gamma and beta particles. A much simpler case would be to consider the disintegrations of polonium which converts directly into lead with no intermediate steps. The method of calculation, however, is the same.

LIBRARY

ANOTHER facsimile of a Mexican Codex has been added to the American Museum Library by the acquisition of the *Codices Indigenas de Algunos Pueblos del Marquesado del Valle de Oaxaca*. This was published by the Mexican Government for the First Mexican Historical Congress held in the city of Oaxaca in 1933. The writings date from the Post-Columbia era and record the period immediately following the conquest of Cortez when he and his men received grants of land and peons from Spain. The documents show the complaints made by the Indians in regard to the rents paid to Martin Cortez, son of the Conqueror, who had become master of large tracts of land in the present Federal District and in the states of Morelos, Guerrero, and Oaxaca.

The Library is endeavoring to maintain as complete a collection as possible of the various codices which have been and still are being issued in facsimile form.

DURING January and February the following *Novitates* and *Bulletin* were published by the American Museum:

NOVITATES

- No. 683. Key to the Males of Nearctic *Dolichopus* Latreille (Diptera). By M. C. Van Duzee and C. H. Curran.
- No. 684. Key to the Females of Nearctic *Dolichopus* Latreille (Diptera). By M. C. Van Duzee and C. H. Curran.
- No. 685. Review of the Tachinid Genus *Calodexia* Van der Wulp (Diptera). By C. H. Curran.
- No. 686. New Species of Carabidae from Puerto Rico. by Andrew J. Mutchler.
- No. 687. The "Argiles Fissilaires," A Series of Opal-Bearing Rocks of Patagonia. By G. C. McCartney.
- No. 688. The "Buckwheat Problem" and the Behavior of the Honey-Bee. By Frank E. Lutz.
- No. 689. Fossil Turtles of Mongolia: Second Contribution. Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 119. By Charles W. Gilmore.
- No. 690. An Upper Miocene Suid from the Gobi Desert. By Edwin H. Colbert. Publications of Asiatic Expeditions of The American Museum of Natural History. Contribution No. 120.
- No. 691. A New Emydid Turtle of the Genus *Geodemys* from Kwangtung Province, China. Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 121. By Clifford H. Pope.
- No. 692. Records of American Bembicidae. By Hugo Rodeck.
- No. 693. Notes on American Lycosidae. By W. J. Gertsch.
- No. 694. A New Species of *Amblycastor* from the *Platybelodon* Beds, Tung Gur Formation, of Mongolia. Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 122. By R. A. Stirton.

BULLETIN

- Vol. XXXIII, Part IV. Anthropometry and Blood Types in Fiji and the Solomon Islands. Based upon data of Dr. William L. Moss. By William W. Howells.
- Vol. XXXIV Part II. Kinship in the Admiralty Islands. By Margaret Mead.

HISTORY OF THE EARTH

THE PRO-GEOGRAPHIC HALL.—Exhibition space has been set aside recently in the American Museum for a Pro-Geographic Hall. It is located on the first floor of the main building in the passageway to the north of the elevators and alongside the main stairway.

The principal features are the materials used by Robert E. Peary in his dash to the North Pole, April 6, 1909, which were presented by the Peary Arctic Club, 1909; those of Roald Amundsen, 1913; two cases containing memorabilia of the Amundsen-Ellsworth airplane flight of 1925, and the Amundsen-Ellsworth expedition of 1926, which flew over the pole in the dirigible "Norge," from Kings Bay, Spitsbergen, to Teller, Alaska; a model of the Dornier-Wal, N. C. 25 airplane, a model of the "Norge," and of the "Polar Star," the airplane which Ellsworth took to the Antarctic continent in 1933. A 1934 addition comprises two polar maps, each seven feet across and including the latest information concerning polar exploration. This data was furnished gratis by the American Geographical Society of New York. A bust of Lincoln Ellsworth, by Sally Clark, June, 1933, has also been included, since it was by means of the Ellsworth fund of 1933, that the reorganization and presentation of this display was made possible.

When the Trustees of the Museum are assured of sufficient funds for erecting an additional wing to the present Museum building space, present plans call for setting aside a Geographical Hall which will include, in addition to the objects already enumerated, the Lindbergh plane "Tingmissartog," the accessories used by the Lindberghs on their 1930, 1931, and 1933 flights and such other geographical material as may prove to be desirable.—CHESTER A. REEDS.

MAMMALS

GERVAIS WHALE.—Recently the American Museum acquired two complete specimens of the rare beaked whale or Gervais whale (*Mesoplodon europaeus*). The first specimen, a subadult female measuring a little more than fifteen feet in length was beached by a long-shoreman at Far Rockaway on December 22, 1933. On January 15, 1934, an adult female was stranded not more than half a mile from where the first one was beached. It measured 16 feet in length.

These two beached whales are the first specimens of this species to be represented in the American Museum collections. They were bluish black in color, with broken, dull-grayish, lateral stripes, and throat and abdomen white. The adult female had assumed a peculiar pinkish color when discovered, which can probably be attributed to the effect of a sharp frost.

The Gervais whale belongs to the family Ziphiidae or toothed whales, which are, with the exception of the bottle-nosed whale *Hyperoodon*, among the rarest of the cetaceans. They are distinguished by their teeth, which are limited to one or two pairs found only in the lower jaw. The Gervais whale has only a single pair situated well back in the lower jaw.

The existence of this whale (*Mesoplodon europaeus*) was first made known when a single specimen was found floating in the English Channel about ninety years ago. Two other specimens have been found on the American coast, an immature male at Atlantic City, New Jersey, in 1889, which is now in the U. S. National Museum, and an adult female at North Long Branch, New Jersey, in 1905, which is in the Museum of Comparative Zoology, Cambridge, Massachusetts.



LINCOLN ELLSWORTH

A bronze bust by Sally Clark loaned by Mr. Ellsworth to the American Museum for exhibition in its Pro-Geographic Hall

REPTILES AND AMPHIBIANS

DOCTOR HARVEY BASSLER has recently been appointed research associate in the department of herpetology at the American Museum. For some years he was in charge of the departments of geology and biology at Albright College. He has also been a member of the U. S. Geological Survey and the Maryland Geological Survey. From 1925 to 1931 he was chief geologist of the Standard Oil Company of Peru. During his extensive travels in South America, Mr. Bassler was particularly interested in reptiles and brought together perhaps the largest single collection ever made on that continent. He has presented the collection to the American Museum, and at the present time he is in Iquitos, Peru, packing the material for shipment to New York. Doctor Bassler is planning to continue his studies on this material and to extend them to the other extensive South American collections in the Museum.

THE seventeenth annual meeting of the American Society of Ichthyologists and Herpetologists will be held in the American Museum, May 10 and 11. A program of scientific papers has been planned, and in addition the Society will be the guests of the Aquarium and the Zoological Park. This meeting will be the occasion of bringing the leading students of reptiles, amphibians, and fishes to the Museum.

MUSEUM ART EXHIBITION

THE Third Annual Exhibition of Arts and Crafts by members of the staff of the American Museum opened somewhat earlier than usual this year. It was held in Maxwell Hall of the School Service Building from March 10 to April 8. The work of former artists and craftsmen as well as a liberal sprinkling of new talent greeted the eye. The sub-arctic weather produced a liberal crop of winter scenes as well as a larger showing of still lifes. Fewer pieces of sculpture and craft work were evident.

William R. Leigh's dramatic "In a Bad Fix," flanked by two small paintings of burros, dominated this year's exhibit. He also showed a characterful Zuni woman's head. In pleasant contrast to the heat and action of "In a Bad Fix" were the cool and restful wood ducks, Florida bird life, and northland caribou and wolves of F. L. Jaques. Lynn Bogue Hunt contributed his striking African elephant cover for the March-April *NATURAL HISTORY MAGAZINE*.

Olenchak's suave black crayon and red sanguine drawings of felines contrasted with the forthright, colorful animal posters, mostly from

Museum material of Roland Rolando. George F. Mason's dog studies, Margaret M. Colbert's hippo head, and the tropical fishes of Bruce Brunner, Chris Olsen's undersea paintings, and Olive Earle's brilliant "Sea Garden" completed the resumé of the living animal world.

The scientific and prehistoric were represented by the convincing pencil drawings of mastodontines by Margret Flinsch, the reptiles of Froderstrom, and the scientific illustrations of Mildred Clemens, as well as the delicately colorful insect studies of Mary C. Easton.

Landscapes and seascapes were well represented by views along the Gaspé Peninsula by Mrs. Colbert, Arthur A. Jansson's brilliant autumn scene and twilight scapes, the lighthouse and Atlantic coast beaches of Louise and John Germann, Joseph Guerry, and David T. Crothers, as well as some little gems by Hazel de Berard. Lieber's craggy mountain scenery, and Guerry's "Adirondack Lakes" were in marked contrast to Olsen's exotic coral isles with waving palms.

Closer to home were Robert Kane's river views and country-sides, as well as the richly wrought autumnal scenes of Crothers and the Germanns. Another homey scene was the "Blue Monday" by Howard Moore. Portraits, fewer in this year's exhibition, included Dudley M. Blakely's study of "Peggy" in green and brown, and the self-portrait of Moore. Character studies by Anna K. Berger and Robert Kane were also included. Contributions of still lifes, widely varied, were Karl Koehn's fruits and arrangements by Kane. In the field of black-and-white were Mrs. Fulda's campfire scenes, Olive Earle's decorative botanical studies, with designs by Hazel de Berard, and book illustrations by Tom Voter.

Dominating the sculptures were the heroic Nandi hunters spearing the king of beasts, by the late Carl Akeley. Animal sculpture included bronzes by James L. Clark of such varied subjects as rhino, seal, and sable antelope; "Bongo" by Robert H. Rockwell, bears by Ferraglio and Christiansen, John W. Hope's panels in low relief of animals for African Hall, and the dogs of M. Flinsch, Robert H. Rockwell, and Fred Mason. Heads by Hope, Flinsch, Snedegar, and a padre by Petersen, as well as the highly imaginative centaur of Ludwig Ferraglio and the interesting astrolabe by Christiansen, completed this branch of the exhibit.

Mr. U. Narahara, with wax, H. O. Mueller with glass, and W. H. Southwick with tiles, showed their virtuosity in craftsmanship, while in the world of the microcosmic were C. Marguglio's miniature paintings on easels, Dr. George

H. Child's tiny animals in natural habitats, and C. McKinley's small-scale model of the Long Island state parkway development. Rounding out this year's showing were a miniature

diorama "The Building of the First Transcontinental Railroad, 1869, by Lee Black, and an attractive batik by Emmy Jazykoff.

—ARTHUR OHLMAN.

NEW BOOKS

Sheep and Bear Trails. By John P. Holman. Introduction by Capt. Robert A. Bartlett. Approved by the Boone and Crockett Club. Frank Walters, New York, 1933, 211 pp., numerous photographs

THIS is a simple narrative of hunting experiences in the mountains of the Northwest, a territory so large, so wild, and so isolated, that only an unfortunate minority of the bear and sheep and goats that inhabit it meet with the handful of hunters who penetrate its fastnesses. Here we learn something of the lives of these animals in the unbroken wilderness; and the lives of the few men, mostly trappers, who share it with them give human interest to the book. The author has been deeply impressed with the beauty of mountains, and forests, and rivers, and has the skill to bring this home to his readers in no small measure, together with some of the love of and satisfaction in untamed nature which actuates her devotees.

In writing of the "Rivers of the North" he says:

"Perhaps it is the wide visions of uncharted mountain ranges that loom gigantic from the mists of early morn or the far sight of snow patches glistening in the noonday sun that bring such sweet content to the weary toiler as he breasts the cold current of the stream and bends his back to the tug of the line; or maybe it is the ever-present song of the river that murmurs all day like a crooning lullaby. Ever at dawn it falls faintly on the ears of the awakening voyager and brings with it a sense of the eternal poise that abides in nature; in the hush of noontime, when the sun bathes the landscape with effulgent light and the wilderness people are resting in the grateful shade of the forests, the gentle lapping of the water breeds a calm content; but it is at eventide that the song of the river speaks to the man who is resting on its banks, with a more potent voice. Then he catches a note that has been lost to him during the restless struggle of the day. It is a note of immortality, without which all things in nature are but as dust—the tone of divine assurance that all is well with the world."

The book is a good one to have on one's shelves to turn to, when the world seems overcrowded.

—J. T. N.

The Universe of Light; A Book for the General Reader. By Sir William Bragg. The MacMillan Company, New York, 1933, 283 pages.

AS we would expect from the pen of so accomplished a lecturer as Sir William Bragg, *The Universe of Light* is written in a delightfully intimate popular vein that will, I venture to say, intrigue his greater audience quite as much as his Christmas lectures at the Royal Institution captivated his London audiences in 1931.

Those of us who have struggled through a course of optics in our University days may well ask: "Why didn't some one write a popular book of this kind before?" The answer of course is that only once in a blue moon does there appear among us a scientist of the first rank who has the gift of making his science readable to the man in the street.

And for this same man in the street there is now opened up a marvelous adventure in the realm that Sir William Bragg knows so well. With singular simplicity and charm the author carries us successively through the intricacies of "The Nature of Light," "The Eye and Vision," "Color," "The Polarization of Light" and "Light from the Sun and Stars," to mention a few of the chapter headings.

Throughout the 110 text figures, and the 26 half tone plates, the illustrative matter has been chosen with great care, and rivals in clearness the admirable clarity of the text. The two color plates are well and truthfully reproduced.

Altogether Sir William Bragg has produced a book that well deserves a place on our shelves beside his *Concerning the Nature of Things* (Harper and Bros., 1925), and that, I think we will all admit, is a high honor.

—HERBERT P. WHITLOCK.

Songs of Wild Birds. By Albert R. Brand. Thomas Nelson and Sons. New York, 1934.

ONE of the problems which has always confronted the beginner in bird-study is the identification of birds by their songs. When an unknown melody is heard and the author of it can be clearly seen, the identity of the songster may be determined with no unusual difficulty.

But how many times is the unfamiliar song heard in a chorus of mixed voices or from behind a leafy screen when the most determined search brings no sight of the minstrel. Then, indeed, is the student in a quandary.

Perhaps the song has been one of such great individuality, so easy to transcribe in simple musical notation, or so suggestive of some syllables of human speech that it is no great task to find a printed description by which the unknown songster may be recognized. Some of these transcriptions may have been learned in advance so that when the bird is heard for the first time, the listener knows what he has found. The loud song of the ovenbird, the mellow whistle of the bob-white, or the melancholy quaver of the screech owl need no great study to be recognized.

Quite otherwise is it with other numerous species whose songs, though recognizable to a practised ear, are not so easily described or are so similar to those of other species that until they have been learned through repeated hearing they remain indistinguishable. Some songs defy description; they conform to no chance phrasing, their distinctive quality is utterly ignored in a musical score. The most careful rendition on musical instruments may give no clue of their identity even to one familiar with the bird in life. A whistled imitation is better but depends for its success on the imitator's personal knowledge of the subject and cannot be put into writing. As for transcription into syllables, the variety of expressions proposed for a single song may be as numerous as the proponents. Such transcriptions can be very useful to assist in the fixation of certain songs in the student's memory, but they are of greatest utility when originated by the individual student, expressing what the bird appears to say to him; they may mean nothing to a companion hearing the same song.

How welcome, then, is Mr. Brand's volume with its accompanying records of actual birds' voices, recorded in nature on cinema film and here transferred to phonograph records that may be played at will and repeated as often as desired. With these there is no guesswork or author's interpretation. The actual birds are singing. There are, necessarily, certain mechanical difficulties in all recording which leave a slight margin of artificiality in the finished product, but a generation accustomed to the radio and sound film makes an unconscious allowance for these variations which detract no element essential to the recognition of the sounds. So far as is possible to modern mechanics, the voice of nature is reproduced in Mr. Brand's records.

In the grouping of the songs, an effort has been

made to bring together those most likely to be confused, and close comparisons can be made to properly assign the shades of difference. Many years could be spent in the field before similar comparisons might be possible. Even to one familiar with the songs in life there is both pleasure and profit in having them thus so readily accessible. The text of the volume is intended to supplement the records and forms a useful adjunct for study in the field. The birds are named with the preferred vernacular and the scientific names for each of the thirty-five species treated in the present series. A short list of other frequently used common names is given for the help of those who may know the bird under one of these other terms. The approximate dates when the song is abundant (mostly, for the vicinity of New York City), the usual location chosen by the bird when singing, brief descriptions of the song, suggestive catch-phrases, and notes on impressions of the mannerisms of the song or songsters are quoted from various observers or given from the author's own experience.

A chapter is devoted to the manner and meaning of bird song and, although it makes no pretense of being a thorough treatise on this complicated subject, it contains much information and recent theory which should stimulate the reader to go deeper into the study. An account of the process, in field and work-room by which the records were obtained and reproduced is of considerable interest beyond the field of ornithology. Doctor Allen of Cornell University supplies a foreword, and a selection of photographic illustrations of birds and apparatus enliven the pages.

Though issued ostensibly as a book for children, the utility of the production will go far beyond those limits and it makes a milestone in man's efforts to bring the great outdoors to do his bidding. There have been other books on the songs of birds but Mr. Brand's is a successful new departure. A host of bird-students, amateur and professional, will wish the author every success in his expressed intention of placing in similarly available form the songs of other American birds.—J. T. Z.

Our Primitive Contemporaries. By George Peter Murdock. The MacMillan Company, New York, 1934, 595 pp., 117 illus.

THE number of professional anthropologists is relatively small, but even so the output of books is impressive,—for America alone an average of about two a month. Naturally these books vary in interest and importance, so we welcome this new volume of Murdock as something aside from the ordinary. It could well be

characterized as the "Book of Eighteen Tribes." The plan of the author was to select from all the various peoples of the world eighteen tribes as types. These range from the lowly Tasmanians to the barbaric Inca, but are so chosen that in a large way these present the whole gamut of primitive culture. Each type-tribe is treated fully and concisely, in fact so crammed are the pages with information that the reader may find the going a bit heavy. Yet if he persists, if he masters the details of each, he may rightly feel that he has more than a bird's-eye view of primitive humanity.

The book should prove a ready source of available information to anyone about to compose a picture or write a story in which the truthful treatment of particular primitive states is desired. It may well prove useful to museum visitors as a general handbook, since in the American Museum, for example, the exhibition hall units devoted to primitive man each present from one to three of the eighteen type-tribes so well described by the author.—CLARK WISSLER.

Cave Life of Kentucky. Mainly in the Mammoth Cave Region. By Vernon Bailey, with chapters on the birds by Florence Merriam Bailey, and on the invertebrates by Leonard Giovannoli. Reprinted from *The American Midland Naturalist*, Vol. XIV, No. 5, pp. 385-635, 1933. The University Press, Notre Dame, Indiana. 254 pages.

IN this book, whose scope is far greater than its title indicates, Mr. Bailey and his colleagues have produced a work which covers almost as wide a field as Funkhouser did in *Wild Life in Kentucky*, 1925. In the present instance, however, discussions of species are definitely oriented to show the relation of that species to the great limestone caves of the state of Kentucky. The general introduction and sections covering the mammals, fishes, reptiles and amphibia are all treated by Vernon Bailey himself. Mr. Bailey's exceptionally long service and wide field experience with the United States Biological Survey, coupled with his own ability as a systematic naturalist, and the fact that he has already produced a valuable work not dissimilar in subject to the present book, viz., *Animal Life of the Carlsbad Cavern*, 1928, are sufficient guarantee of the excellence of the study which we are discussing. In the introduction a synopsis of the history, geography, botany (with a list of the woody vegetation), and general environment of the cave region is presented. Touching upon the subject of conservation, the author advocates (pages 25 to 27) the establishment of well-administered wild life sanctuaries, where game may breed uninterruptedly and from which a continual overflow into neighboring areas will permit a certain amount of well-regulated

hunting. Mr. Bailey has had the benefit of the coöperation of a number of specialists in the United States National Museum in working out many of the special groups about which he writes, and presents the facts concerning cave-inhabiting fishes, reptiles and amphibians in a most interesting manner.

The section on birds by Florence Merriam Bailey of necessity is less closely related to the limestone caves. She deals with the avifauna of the mammoth cave region as a whole. Her presentation of the many species is in the well-known and sympathetic manner of her handling of the bird section in *Wild Animals of Glacier National Park*, 1918, and her *Birds of North America*, 1928.

Mr. Leonard Giovannoli has limited himself quite strictly to the cavernicolous invertebrate fauna, and the greater part of his observations appear to be original.

The book is admirably planned and written and is illustrated by 90 text figures. Some of these figures are half-tones drawn from various sources, and some are line drawings. A bibliography of 162 titles, more than a hundred of which are ornithological, and a good index conclude the work.—G. H. H. TATE.

The Birds of Dutchess County. By Ludlow Griscom. Transactions of the Linnaean Society, Vol. III.

FRIENDS of the late Maunsell S. Crosby, of Rhinebeck, will be delighted to see that the ornithological notes he kept so scrupulously through many years have been worked into definitive shape by Mr. Ludlow Griscom, formerly of the American Museum's department of birds, and handsomely published, in a volume of 184 pages and three plates, by the Linnaean Society.

The work, which is thus a collaboration by two capable and ardent field workers, is a model regional study. Introductory chapters trace the somewhat scanty ornithological history of Dutchess County, in which the youthful labors of President Franklin D. Roosevelt find a place, and which culminated in the sustained and enthusiastic studies of Crosby and his innumerable guests. Another chapter describes the territory with its rich and varied environment, after which the seasonal status of the birds, the migrations, the notable one-day censuses, and the counts of breeding birds on Grasmere, Mr. Crosby's estate, all receive attention.

The final section, save for the bibliography, is devoted to an annotated list of the 254 species of birds recorded from the County. Although the notes are mostly brief, they contain exactly the information for which the field worker and the

ecologist would seek. Mr. Griscom and the Linnaean Society are to be congratulated upon

the production of a useful and well-deserved monument to Mr. Crosby.—R. C. M.

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
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Blazing the Trail . . .

NATURAL HISTORY might be said, in the jargon of the day, to have had its face "lifted," and we hope that our readers will be pleasantly impressed by the effects of the operation. The magazine is, of course, only thirty-four years old, and among humans that age might not bring about the necessity for such a transformation in appearance. But styles do change, even in magazines. Hence our new departure.

♦ ♦

The "Vanishing" Americans Many people imagine, because the war whoop is heard no more and the scalping knife is not put to its former use, that the American Indian has almost entirely gone from the land. This, we are glad to announce, is fallacious, and because of the changes that are proposed for the government of the Indians, we have asked Dr. Clark Wissler, curator-in-chief of anthropology at the American Museum and one of the world's outstanding authorities on the American Indian, to write an article for the next number of NATURAL HISTORY on the "fall and rise"—we think that that is a fair way to put it—of one of the most appealing of the native races of the world.

♦ ♦

An Expedition Returns from New Guinea These days of depression have made their inroads on the number of expeditions sent into the field by the American Museum, but they are still being sent, and though to us stay-at-homes it seems that some of them remain in fascinating corners of the world for enormous lengths of time, they do return eventually, burdened with collections of great importance, and brimming with facts freshly gleaned. In the next number of NATURAL HISTORY a pictorial record of the Archbold 1933 New Guinea Expedition will be published, showing in more than usual detail the camera record of scientific work in a distant and difficult field.

♦ ♦

Autumn Flowers Now and then members of the staff of the New York Botanical Gardens have contributed articles on their delightful botanical subjects, and we are especially pleased to have prevailed upon them to do so again

for the next issue. This time Mr. T. H. Everett, of the Botanical Gardens staff, has written an article on autumn flowers which, at least when autumn comes, we so often feel are the loveliest of all.

♦ ♦

An Observer, a Writer, and an Artist Careful observers are not invariably able to record their observations in language appealing to lay readers, and perhaps more rarely are they able to paint attractive pictures of what they see. For the September number of NATURAL HISTORY, however, we have obtained an article by one who is not only an observer, but is a writer and an artist of merit as well. Dr. Henry Smith Williams is the contributor who is so generously gifted, and we are fortunate to have an article on his observations of certain birds, together with his etchings and paintings of them. A few of these will be reproduced in color, but to our eye, at least, there is real color even in those that will appear in black and white.

♦ ♦

Carved Jade, Ivory, and Amber The most interesting and attractive of recent acquisitions of the American Museum is the Drummond Collection of Chinese and Japanese jade, ivory, amber, etc. The collection is already installed as a unit in its own hall, and now for the first time NATURAL HISTORY has an opportunity to present some of its details. Mr. Herbert P. Whitlock, curator of minerals and gems, and the member of the Museum staff responsible for the Drummond Hall, has written an article for the next number about this extraordinarily beautiful presentation of oriental art. The illustrations will portray some of the more outstanding and artistic pieces of the collection.

♦ ♦

Arts and Crafts of Pre-Columbian Central America Dr. George C. Vaillant has written several articles in a series on the art of Pre-Columbian Central America. The next in the series will be on the arts and crafts of the same region and the same period. Popular articles on this subject have been extraordinarily rare which, since we have seen Doctor Vaillant's article, seems strange indeed, for the material possesses unusual interest.

The Cover Painting

"The Portage," a painting by Mr. Francis L. Jaques of the American Museum staff, has been used on the cover of this issue. It typifies one phase of the canoeist's paradise, and has, we believe, a real appeal to every individual to whom the attractions of the out-of-doors lead him, periodically, to live for a time in the wilds.

By . . . **GEORGE GAYLORD SIMPSON**

(Associate Curator, American Mus. of Nat. History)

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NATURAL HISTORY

The Journal of the American Museum of Natural History

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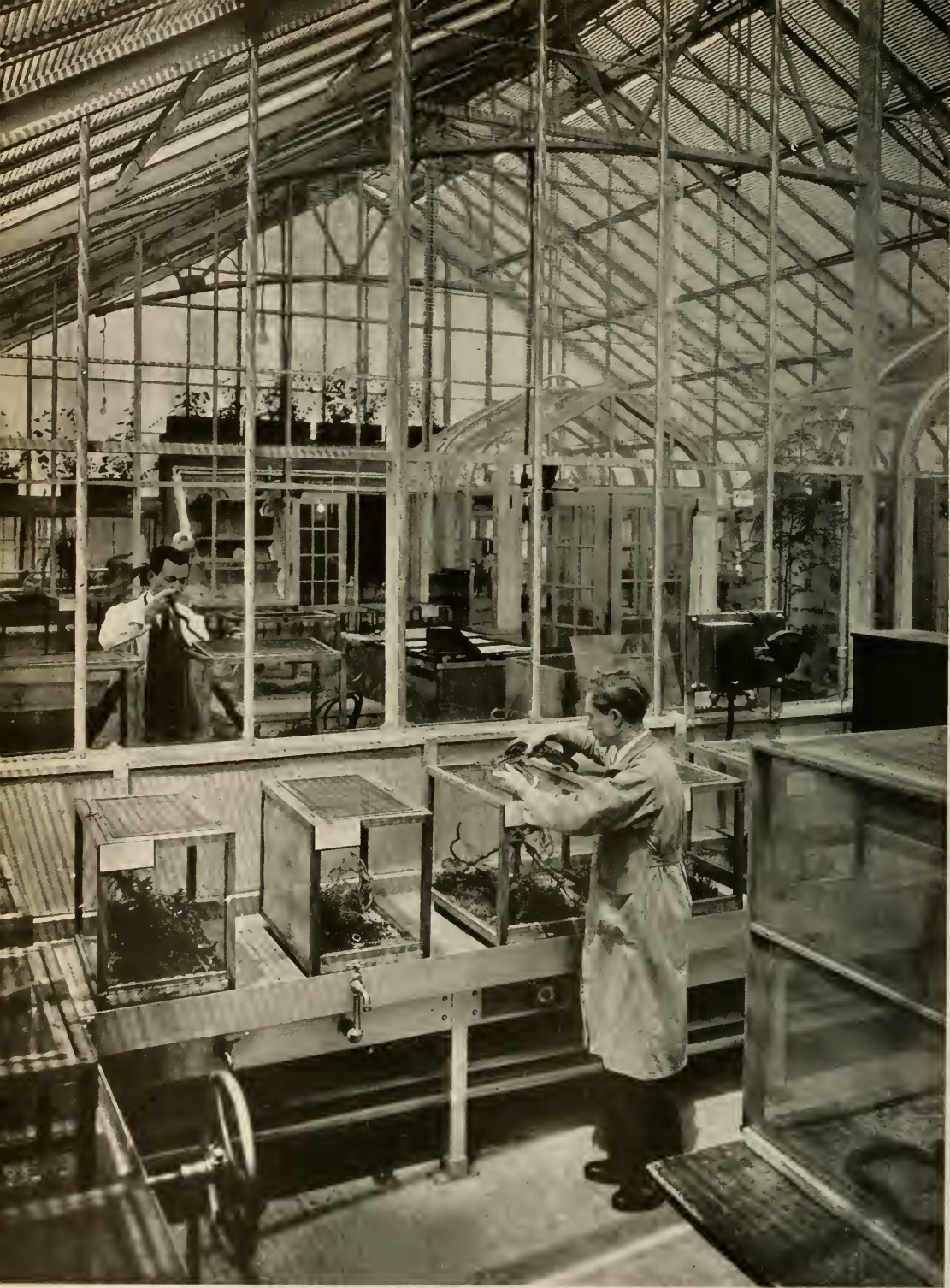
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HAWTHORNE DANIEL
Editor

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Associate Editor

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Research

The department of experimental biology at the American Museum has recently taken possession of its new laboratory which is complete with the most modern equipment and facilities for experimental work. The picture reproduced on this page is the first published photograph of the laboratory

Trails and Camp Fires

by

Frank R. Oastler

Twenty-nine photo-
graphs by the author

No better way of becoming acquainted with Nature has yet been devised than the method of the camper, and to the citizens of North America an infinite variety of camping possibilities present themselves

FORMER President Coolidge considered the matter of outdoor recreation of so much importance that he called together a National Council on Outdoor Recreation for the purpose of coördinating the various agencies interested in this subject. Now that working hours are being curtailed and men have more time for leisure, a careful study of outdoor recreation becomes still more important, for there is nothing more distressing or demoralizing than idle hours.

Of all forms of outdoor enjoyment probably camping offers the greatest diversity of amusement. Those of us who live on the North American Continent, including Canada and the United States, are particularly fortunate in the opportunities offered for camping under practically all kinds of conditions that afford the greatest variety of interest. As a result, the fun of camping is attracting increasingly larger numbers every year, and, with the introduction of the automobile, the desire to learn what is just around the corner has become almost universal.

Camping solely for recreation occupies the attention of the average man, but today the National Park Service of the Department of the Interior is urging the outdoor man not to be satisfied alone with recreation, but advises him to take advantage also of the opportunity offered to add to his knowledge of the things about him. In fact the Secretary of the Interior has placed education ahead of recreation in the conduct of our national parks. The joy and freedom of the great outdoors may be in itself all sufficient, but how much greater may be the pleasure derived from a knowledge of the things about one and the interpretation thereof. To the average person a forest is simply a piece of ground covered with trees offering a certain amount of shade. How much more interesting this forest will become if one is told about the mammals, birds, kinds of trees, plants, and flowers, together with the character of the soil from which the trees and plants grow. Then, if there may be added an insight into the various evolutionary processes that have taken place to bring about these present conditions, as well as a realization of the interdependence of animal and plant in the forest, a simple forest of ground and trees becomes a training area with possibilities of the greatest interest, and unlimited opportunities for stimulating research—and so we find recreation



Photograph by Ewing Galloway

By Horse or Canoe



Whether one cares to paddle his own canoe through a New Brunswick sunset, prefers to lead his pack train across the Saskatchewan River into the Rocky Mountains of Alberta, or feels the need of other camping grounds, Canada can go far toward meeting his demands

By Automobile

So practical is the automobile these days that, although it may occasionally need a little help, as this picture in the Painted Desert of Arizona demonstrates, it offers the ideal means of visiting distant camping grounds, and serves perfectly the needs of those who prefer the beauty spots along our many excellent highways



Photograph by Ewing Galloway



proceeding hand in hand with education to the end that it will be difficult to determine which phrase may be more appropriate for consideration—the educational advantages of recreation or the recreational advantage of education.

CAMPING IN MANY FORMS

In our country all forms of camping may be undertaken. There are pack-train trips with horses, guides, and cook, canoe trips of various sorts, automobile trips with a suitable spot to camp in tent or cabin at night, camping trips through the national parks and forests where tents or cabins are provided and you may prepare your own food or obtain it at near-by cafeterias, camping in the state parks where you may erect your tent and remain as long as you wish, or, if there are only a few days at your disposal, you can just pitch your tent by some lively stream wandering through a near-by bit of cool woods with a modicum of animals, birds, and flowers round about and maybe a few fish in the stream—and let us not forget a congenial companion or two.

Those who are particular about climate can certainly be accommodated in North America. There are all varieties, from the cold winds of the mountains of Alaska to the heat of the southwestern deserts of New Mexico, Arizona, and California. For great wilderness areas with towering mountains, tumbling glaciers, and tundra unlimited, and a fair abundance of wild life, Alaska has no equal. For real scenic beauty of mountain and lake, the Canadian Rocky Mountains are supreme. Camping in the arid regions has its peculiar fascination and charm. The state of Utah probably affords greater opportunity than any other with its grand cañons, unique monuments, natural bridges, and colorful deserts—and, too, those who have experienced the joy of living on the deserts of Arizona and California with their sand dunes, chocolate

mountains, flowering cactus, giant saquaro, sublime yuccas, peculiar wild life, and wonderful sunsets cherish these memories for years to come. Probably the most enjoyable camp sites are those in the national parks and forests of Canada and the United States, of which there are many. Here may be found all types of scenic beauty with its geologic story, its great variety of wild life, forests, flowers, waterways, and an unlimited number of good trails for man and horse. These national parks and forests extend across the continent and so are within reach of all the people of our country.

SOURCES OF INFORMATION

Camping nowadays has become so popular that the transportation companies, both bus and rail, have established information bureaus furnishing all kinds of information about camp sites, ranches, fishing, climbing, and hunting, so that the tenderfoot may be properly cared for. Also throughout the country, especially in the western states, are many organizations, outdoor clubs that hold meetings for two or three weeks each year in some wilderness area where the outdoor man is always welcome. Here the spirit of the outdoors is at its best. You can always find congenial companions. Every day brings an interesting trip and at night the camp fire with its accompaniment of songs and weird tales helps to cement the friendships of the day. Camp fire—what a lot that means to the man who has been privileged to enjoy its subtle charm. The merry crackle of the burning wood, the flickering blaze casting its brilliant array of sparks into the shadows of the night, the whirl of the smoke turning and twisting each little cloudlet into fantastic shapes to be lost at last in the starry heavens—and you sit and watch the embers and gradually become at peace with the world. A soothing calm invades your soul and if there be anything of good



The Pacific Northwest offers a great diversity of beauty to the camper and the naturalist. Within easy reach of Portland, Seattle, Tacoma, Spokane, and Vancouver lie many of America's most appealing wilderness regions

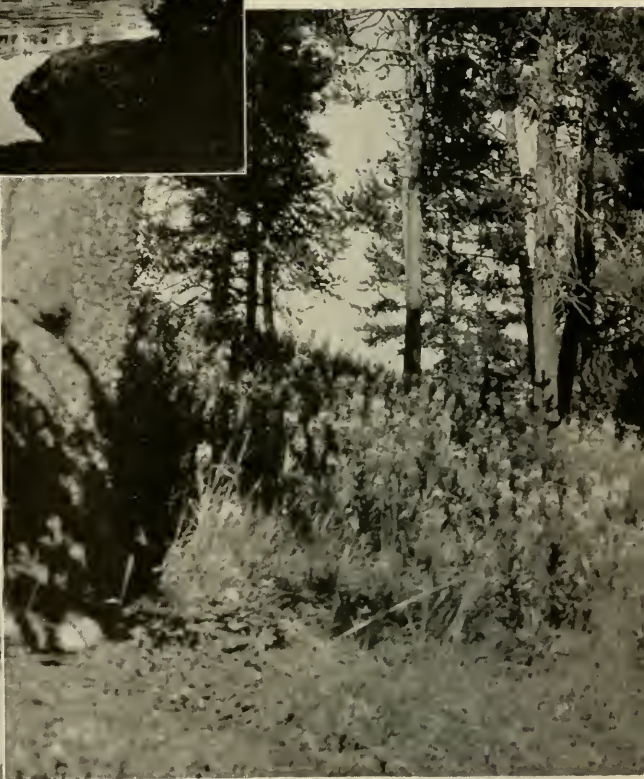
Spray Park Mt. Rainier

There Are a Thousand



Haiduk Lake in the Canadian Rockies. For real scenic beauty of mountain and lake, the Canadian Rockies are unsurpassed

Hidden Lake in Isle Royale, which lies in Lake Superior. Here the canoeist finds ideal conditions for the kind of camping he desires



Probably the most enjoyable camp sites are those in the national parks and forests of Canada and the United States, of which there are many. Here may be found all types of scenic beauty with its geologic story, its great variety of wild life, forests, flowers, waterways, and an unlimited number of good trails for man and horse

Places in
which to
Camp



Freshfield Ice Field in the Canadian Rockies. Alaska is not the only place in which one may camp amid glaciers



Open forest and fire weed near Dead Indian, Wyoming. This state offers many camping grounds in addition to the unsurpassed attractions of Yellowstone National Park



Rainbow Natural Bridge, in Rainbow National Park, Utah. The state of Utah probably provides more spectacular camping grounds than any other

Fauna and Flora

The camper finds it impossible not to be interested in the wild life and the vegetation that surround him. Even these Wyoming prairie dogs assume a new importance to the person in camp near by



An Abert squirrel
in the Grand Cañ-
on of the Colorado



A black bear of the
Kenai Peninsula, Alaska,
and above it a mule deer
of the Cascade Range
in Washington, both of
which, unfortunately,
are rarer than they once
were



"The Wood Pile"—a dramatic bit of the Petrified Forest in Arizona

A magnificent redwood forest on the Eel River in California

A Florida bayou, where the trees are almost invariably draped with Spanish moss



in you it will grow and grow, and from that camp fire you will rise a bigger and better man. And your pals will become real pals. Among such organizations are the Alpine Clubs of Canada and America, the Sierra Club of California, the Mazamas of Oregon, the Appalachian Club of Massachusetts, the Mountaineers of Seattle and Vancouver, the Trail Riders of the Canadian Rocky Mountains, and many others.

WHAT IS THE BEST TIME?

A question that is often asked is what is the best time of the year to camp. Here opinions differ greatly. Probably the best way to settle this question is to find out what you are camping for. As good a summary as any is the following; Fishing, May and June; Wild Flower Study, May, June, July; Mountain Climbing—Alaska, March and April; Canada and the United States, July and August; Photography—Birds, May, June, July; Animals, June, July, and September; Hunting, September, October, and November, depending upon the legal shooting season for the bird or animal sought; Scenery, all seasons.

Probably the most important things to know about camping after you have chosen the time and place are cost and equipment, and of course that depends on where you are going and what you are going to do. Pack-train trips mean horses, guide, cook, camp outfit, and food. An average charge per day for this service will be about \$30 which includes everything except personal equipment and bedding. Canoe trips are less expensive and may be taken for about \$10 a day. Automobile camping includes the cost of the outfit, tent, cooking outfit, bedding, food, and the cost of running the car. In our national parks this cost is very low, and the auto camps are consequently well filled during the summer months.

Alpine climbing requires a tent, camp outfit, food, and a trained mountain guide. Guides may be engaged for \$5 a day. And a word about guides and cooks. A real guide is a true friend, a man ever mindful of your welfare, a natural lover of the wilderness, a man thoroughly conversant with the rules of the game and one who will not allow them to be broken, a man whose friendship adds much to your life and whom you will always remember as among the best of human kind. Oddly enough, such a man is not hard to find in our wilderness areas.

Cooks, however, are born, not made, and few of them are born. A bad cook will spoil your stomach and your trip. A good cook is a joy forever and almost never can be found in the woods. When you find one, cherish him as you would your birthright. If you find he does not know the meaning of the word lard, you have made a real find. Cicero has written that woman is a variable and changeable thing. So is a cook. But the cook has the edge on the woman. Generally, in camping you put up with your cook. You don't enjoy him, and you are ever grateful that the good fresh air and outdoor life will fortify your digestion so that you may survive in spite of, not on account of, your cook. And what is worse, everyone thinks he knows how to cook—and there is the rub.

EQUIPMENT

It is hardly necessary to consider the question of equipment. All the sporting goods establishments have lists and prices and most of the guides know the requirements for the particular region in which you are going to camp. Each camper has his own particular fads and there are as many as there are flies in a typical fisherman's fly book. It is well to remember one or two things, however.

Make yourself as comfortable as possible when you are in camp, but do not



Photograph by Ewing Galloway

A New Jersey Lake

It is not usually essential for the camper to travel far to find an appealing camping ground. The Appalachian Trail extends from Mt. Katahdin, in Maine, to Mt. Oglethorpe in Georgia, and passes near most of the important cities on the Atlantic seaboard. The Great Lakes and the St. Lawrence River offer many opportunities. Even the prairies offer much to the camper, and the deserts, the mountains, and the forests of the Far West present infinite possibilities, many of which, however, can be reasonably well offset by some spot nearer home, such, for instance, as this small lake

On the Trail

A Miramichi River
portage in New
Brunswick

A party ascending Mt.
Rainier, Washington



A pack train beside the North
Fork of the Saskatchewan
River in Alberta



By the Way

Salmon fishing in the
Copper River,
Alaska



Resting on the
top of Mt. Rainier,
Washington



Supai Indians in Havasupai
Cañon, Grand Cañon of the
Colorado, Arizona





Camp Porcupine,
surrounded by the
Canadian Rockies



A tipi among the trees of White
Man's Pass, Canadian Rockies.
It is probable that no other
country in the world has more to
offer the camper than Canada

Camps and



A temporary shelter
at the foot of Mt.
McKinley, Alaska



An Apache Indian wickiup be-
side Roosevelt Lake, Arizona.
Indians in the United States are
no longer to be found among their
natural surroundings save in the
Southwest

An automobile camp
in the Mojave Des-
ert, California



Camping at the headwaters of
the Athabasca River in Alberta.
The canoeist who cares to do so
can slide his craft into these
waters and continue north for
2000 miles or more



More Camps

Beside Leman Lake,
near Palliser Pass in
the Canadian Rockies



A permanent camp on the shores
of Stony Brook Lake, New Bruns-
wick. Eastern Canada, New
England, and New York offer an
infinite variety of possibilities
for the camper. Log cabins are
to be found within an hour of
New York



take along a lot of things you think you might need but never do. There is a popular idea, especially among younger people, that in order to establish your prowess as a camper it is necessary for you to make yourself uncomfortable. This idea has gone out of fashion. Don't sleep on the ground if you can do better; don't keep yourself wet when you can keep dry; don't eat improperly cooked food, and don't allow flies and mosquitoes to pester you almost to death when a bit of mosquito netting or fly dope will help. Seasoned campers take advantage of every opportunity to be comfortable. Often, unfortunately, this may not be possible, but do not try to make yourself miserable. Amundsen truly said that the story of the successful trip was the story of few thrills, for little happens out of the ordinary when a trip is properly planned. Take along every possible convenience such as sleeping bag, air mattress, good food, and equipment. Don't forget a muslin inner tent to keep out the flies and mosquitoes. Be well shod, warmly clad in cold weather, the reverse in hot. For those who enjoy photography a Graflex camera and a 16 mm. moving picture machine will prove useful. Pack all your film in tin boxes sealed with adhesive tape and take plenty of film. It is the luck of the game to run out of film just when something of importance happens.

WHAT TO EAT

About food—a dollar a day per man is sufficient. Build your food supply around these essentials, flour, tea, sugar, salt, and bacon. After that you may add eggs, butter, potatoes, canned milk, chocolate bars, cereals, and jam. If you have horses, canned vegetables, meats, and fruits are acceptable. All should be properly packed for protection against heat, moisture, and wear and tear. Variation in your food supply will depend upon climate and mode of camping. Butter,

for instance, is of no value on the desert.

There are many things in camp life that tax the patience of the most phlegmatic individual; in fact, there are few other things in life that bring out the good or bad qualities of a man in a better manner than camp life. Every man should realize that he must train himself to meet all kinds of difficulties and temptations with a smile, and if he finds that he cannot play the game when things go wrong, he had better not camp. Realize that you are on trial and do not allow any fellow camper to feel that the camp would be better without you. Do your part, take your share of the dirty work, and when things go wrong, show the stuff that is in you and crack your best joke. If you are hunting, take your fair share of the sport but don't be a game hog.

CONSERVATION OF WILD LIFE

There are 6,000,000 hunters in this country who hunt game every year and the automobile can go almost anywhere a man can. Our wild life is diminishing largely through the depredations of civilization, but do not fool yourself into the belief that hunters cause only an inconsequential percentage of this loss, as some would have you believe. Finally, always remember that there will be another fellow coming after you who wants to enjoy himself as much as you do. Leave things the way you found them. Do not forget your trail manners.

In conclusion remember that the wild things of the continent are in your hands. They do not belong to you but were given to you as a heritage to care for and hand on to those who come after you. Guard your trusteeship well so that camping may be regarded by all as the sport of a gentleman and a real sportsman. All nature is dependant upon the outdoor man for its existence. Destroy it and you dissipate your inheritance. Preserve it and you become rich.

Sea Serpents

by

William K. Gregory

Curator of
Ichthyology and
Comparative Anatomy
American Museum

Sea serpents have, of late, been much before the public, and questions concerning them have consequently been coming with great frequency to members of the American Museum staff. This account, it is hoped, will play its part in explaining these "monsters."

DAVID the psalmist said in his haste, "All men are liars," but he evidently forgot the dupes. P. T. Barnum said, "The public loves to be humbugged," and "A sucker is born every minute." One every second would probably be nearer the truth. Even Lincoln, with all his good will toward mankind, admitted that "You can fool part of the public all the time and all of the public part of the time." Possibly ninety-nine per cent of the population of China believes devoutly in dragons, while untold millions of Americans lap up everything printed in the tabloids, including astrology and not mentioning the other fifty-six varieties of lucrative mythologies. In brief, *Homo sapiens* (who applied this name to himself) would doubtless have been more accurately designated as *Homo mythophilus*.

The old serpent of Eden had no trouble in fooling one human, but the serpent of Loch Ness numbers his dupes by millions. The *London Illustrated News* spread the glad tidings by having its staff artist draw pictures of the monster as described by "eye witnesses." Does this tell us something about the sea serpent or something about the eye witnesses?

The "junior veterinary student" who first described the stranger as "a cross between a seal and a plesiosaurus" was at

least partly right, however, for, after a thorough investigation, Mr. Hinton, the able keeper of mammals in the British Museum of Natural History, concluded that the Loch Ness "monster" was a seal. How disappointing! How much more romantic the explanation attributed to the abbot of the near-by monastery, namely, that the Loch Ness creature was a possible survivor from the Devonian Age!

"But," reply the true believers, not without heat: (1) "Are there no mysteries in science? (2) And especially is it the proper attitude of mind for a curator in a public institution to shut his eyes against new discoveries? (3) What about the testimony of the officers of H. M. S. 'Dædalus' and many other equally high-class witnesses? (4) What about the recent official entry in the log-book of the 'Mauretania'? (5) And what about the sea monster thrown up on the beach in Normandy, with a head and neck like a camel? (5) Might there not be undiscovered survivors of the dinosaurs and plesiosaurs of past ages?"

Yes, yes, my dears, one at a time, please! As to QUESTION No. 1, natural history is almost nothing but mysteries. Every naturalist can tell you hundreds of astonishing, utterly unexplained facts, and every new discovery reveals new mysteries lying underneath the surface in



Should one of these huge reptiles appear to-day, few would hesitate to label it a sea serpent. This nothosaurus lived, however, in the Triassic Age, and has been extinct for some one hundred and sixty millions of years

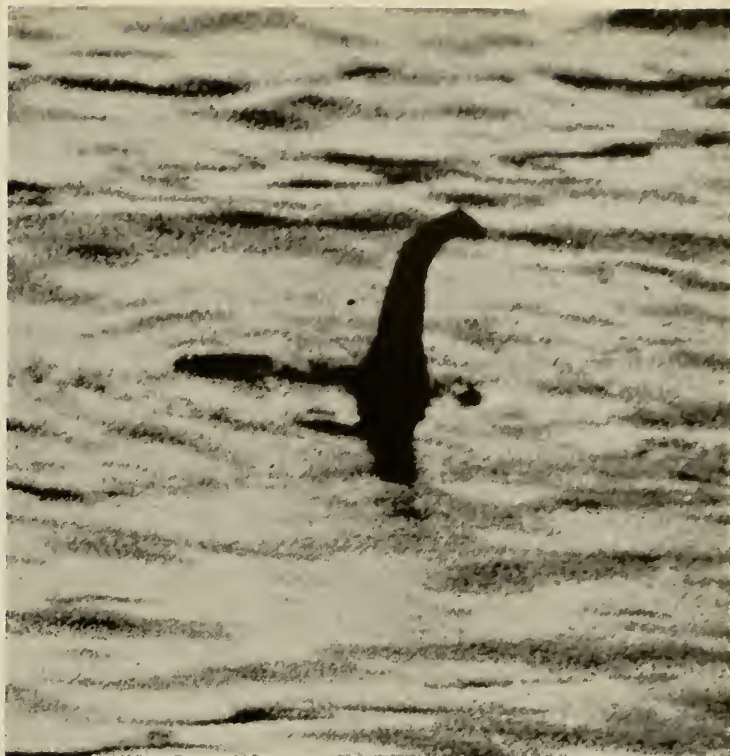
*Restoration by
Dr. Eberhard Fraas*

The artists of an earlier time did not permit facts to hold them too much in check. One of these monsters would appear to be related to the elephant, while another has fins on its horns

By Joannes Stradan



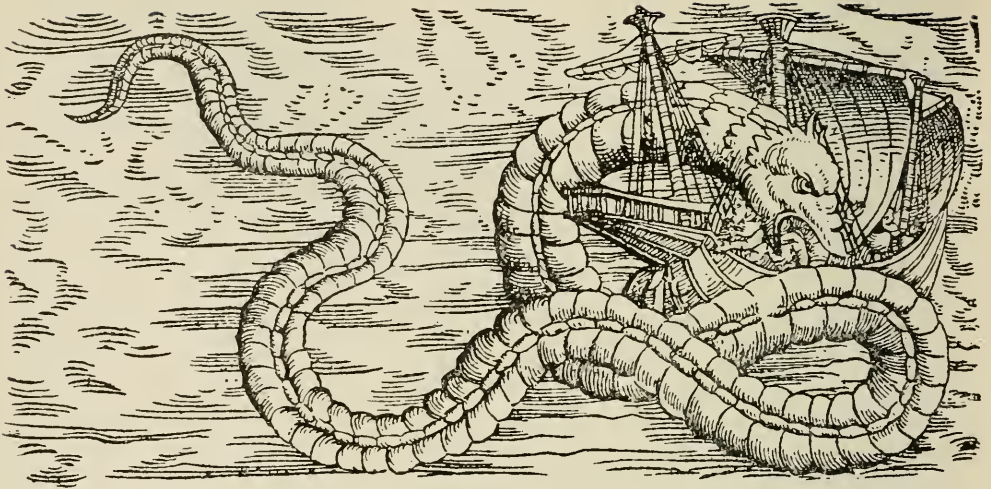
The best obtainable photograph of the "Loch Ness Monster" that has appeared so often in the news of late. According to Dr. Roy Chapman Andrews this silhouetted "head and neck" bears a marked resemblance to the dorsal fin of a killer whale



One could hardly ask for a better "sea serpent" than this twenty-seven-foot mosasaur, but unfortunately it has been extinct since the Upper Cretaceous Age—say eighty million years

*By Charles R. Knight
after Henry Fairfield Osborn*





An especially vicious sea serpent, as imagined by a medieval artist. From Olaus Magnus

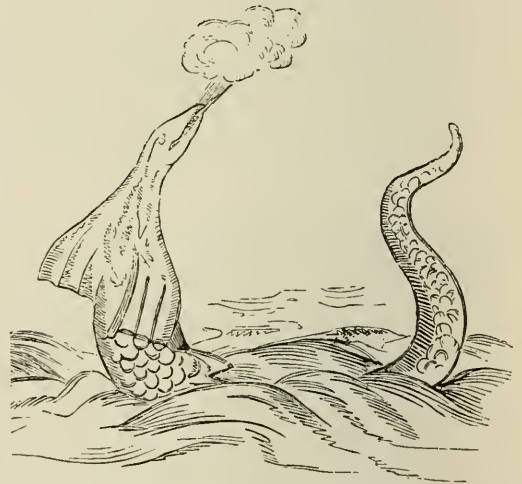
an endless sequence. But there are the mysteries of Nature and the mysteries of Man. How to tell the myths from the mysteries is the problem set for the naturalist.

QUESTION No. 2.—If museum curators did not lose their early trustfulness, their collections would soon be stocked with “genuine mermaids,” angel or monk-fishes, “fossil” human heads, and casts of (hippopotamus) footprints made on the spot for the Loch Ness monster.

QUESTION No. 3.—The officers of H. M. S. “*Dædalus*” cannot now be reached for cross-examination, and if they could we would only have more testimony instead of evidence.

QUESTION No. 4.—As to the alleged entry in the log-book of the “*Mauretania*,” “*Cherchez le journaliste*” (press agent).

QUESTION No. 5.—The sea monster at Querqueville, Normandy, was fortunately examined on the spot by an accredited representative of the Paris Museum, M. Petit. He took back to his laboratory pieces of the backbone, the skull, and various other parts. According to later reports of the *New York Times*, upon the

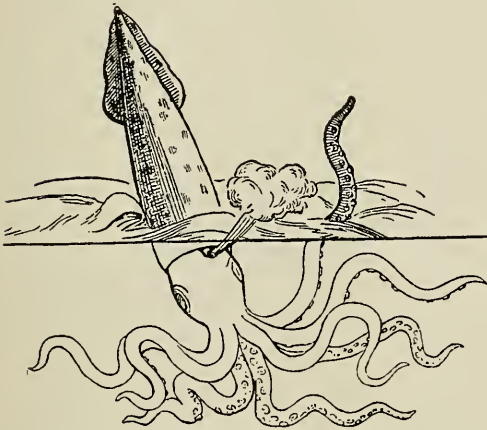


Hans Egede's sea serpent, as he described it in 1734

basis of examination and comparison of these parts, M. Petit identified the animal as a basking shark (*Selache maxima*). Meanwhile, according to *The Field* and *The Illustrated London News*, both of March 10, 1934, Mr. J. R. Norman of the department of fishes, British Museum of Natural History, who compared the photographs of the Querqueville specimen with specimens in the Museum, “found that the skull corresponded with that of a basking shark in every particular, while there was a close resemblance between the sections of the vertebræ.” The long

"neck" of the fish was only what was left after the huge jaws and gill-arches had been torn away. So much for the "camel's head and neck."

QUESTION No. 6.—There are several reasons why museum curators are unwilling to credit newspaper reports of living dinosaurs, plesiosaurs, and the like. During the 117-odd millions of years of the so-called Age of Reptiles such creatures swarmed from Greenland to Australia, and their catalogued remains in the museums of the world must run into the thousands. But for reasons that may be



There often are real explanations for sea serpent stories. In this drawing, H. Lee shows how Egede might have mistaken a giant squid for the monster shown opposite

conjectured but not wholly proved, these reptiles apparently went out with the Age of Reptiles itself; that is, their fossilized bones are never found above the beds of Upper Cretaceous age. Then, for tens of millions of years, sharks, whales, and later, seals, became the dominant giant marine types, leaving their remains in great numbers in marine formations of the Age of Mammals. And it is precisely these forms, sharks, whales, and seals, which appear to give rise to at least most of the sea-serpent stories that are not wholly fabrications.

Then again, hundreds of hard-headed American whalers scoured the seas of the world for generations, but after an exhaustive examination of a great number of their log-books, Doctor Townsend, director of the New York Aquarium, never found a single entry of gigantic "sea serpents." It is the "well educated" officers of yachts and warships that report "sea serpents" moving in great vertical humps in a manner otherwise unknown among vertebrates. And so officially, so far as we are concerned, the sea serpent is still classed with the hoop snake.

The opposite poles of eager credulity and hard-boiled resistance to "testimony without evidence" are well illustrated in this cartoon by George Wotherspoon



Drawn by
George Wotherspoon

To Antarctica Again

by

Lincoln Ellsworth

Trustee, American Museum
and Leader of the Ellsworth
Antarctic Expedition
Twelve Photographs
from "Wide World"

In order to fly across the South Polar Continent from Deception Island to Ross Sea

AT four-thirty on the morning of January 13, 1934, my expedition to the Antarctic was suddenly and unexpectedly terminated. The months of preparation, the 18,000-mile voyage of the "Wyatt Earp" from Norway, the thought and labor of the most loyal of associates, and the plans I had laid for years were abruptly brought to nothing by the sudden an inexplicable breaking up of the ice on which our plane was resting and beside which our ship was moored. Within fifteen minutes the apparent security of the seemingly rigid ice was turned into a broken, shifting bedlam of grinding floes, with the plane damaged beyond hope of immediate repair and the ship herself in danger.

And yet, disappointed as we were, the expedition was far from valueless, despite the fact that we were forced to retreat with the battered plane on deck and the possibility of further work during that season ended.

It had been my plan to fly from the shelf ice of the Bay of Whales, which lies at the southern edge of Ross Sea between the 163d and the 166th meridians of west longitude, across Antarctica to the indentation made by the Weddell Sea, which lies due south of South Georgia. Inasmuch as bases could not be set up both at the Bay of Whales and in the Weddell Sea, this plan necessitated a round-trip flight of about 2900 miles, with the return duplicating almost exactly the first half

of the journey. That such a flight would be of great value is unquestionable, but our misfortune last January, which forced us to abandon our activities for the season, gave us an opportunity to make further plans for our future efforts, and those further plans have been made in order to accomplish all that we had expected to accomplish in the first place, with added work, all of which, oddly enough, can be performed by a flight about 100 miles shorter than the original plan would have necessitated.

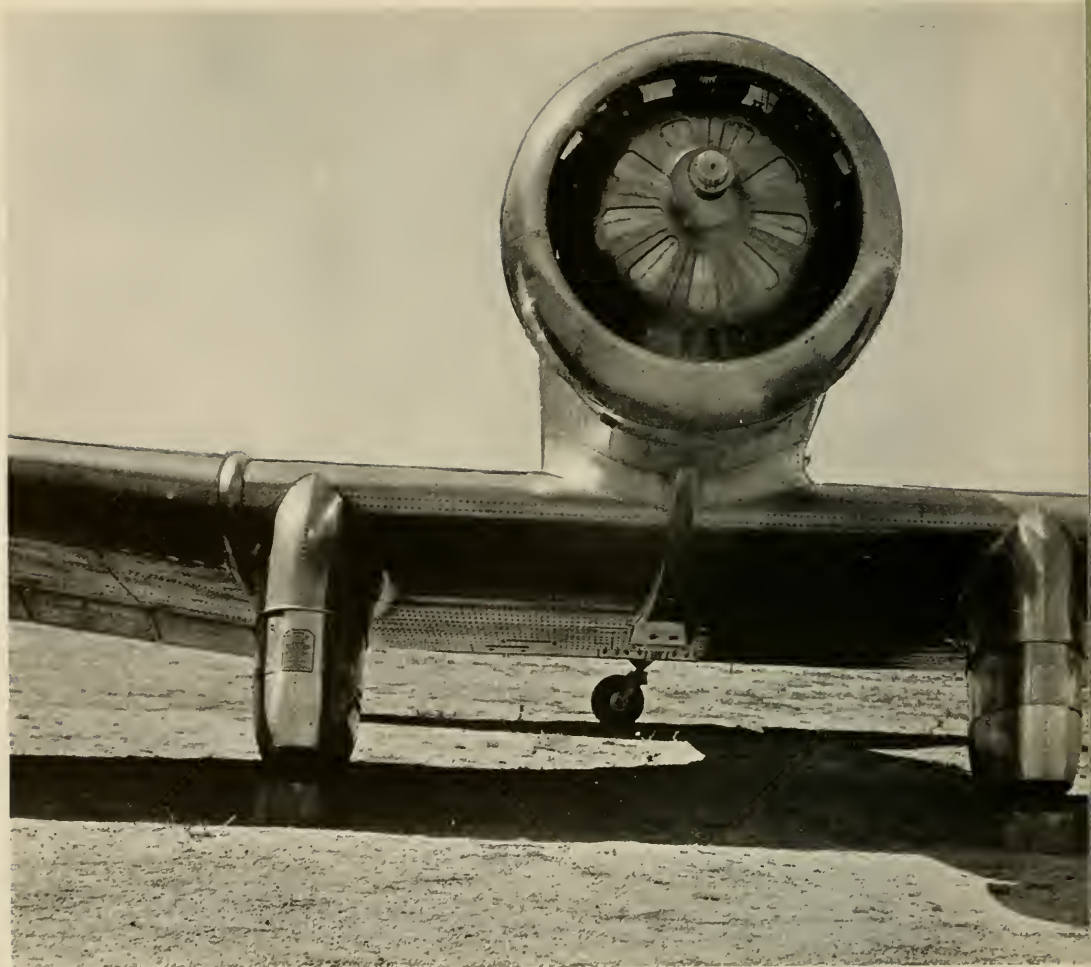
The fascination of the Antarctic still lures me, even after the disappointment that brought about the abandonment of my January flight. It is natural that I should feel that the task I set myself is incomplete, and I have consequently decided to go south once more with the same essential object in mind as that which took me there before. The opportunity to play a part in the exploration of a continent is not given to everyone, and Antarctica contains the last great area of unknown land in the world today. No other unexplored land mass even remotely comparable in size awaits the inquisitiveness of man, for Antarctica is larger than all of Europe, and as yet only a minor fraction of its immensity has been seen and recorded by man.

The months of October and November are, without doubt, the best for flying in the far south, because these bring the Antarctic spring—a cold spring, to be sure, but clear and without fogs. However, the enormous fields of heavy pack ice in Ross Sea do not break up so early, and

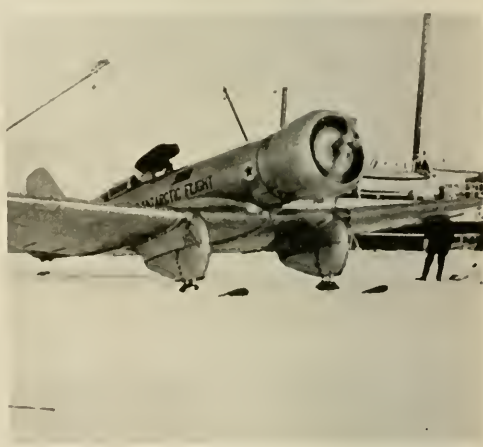


The expedition expects to reach its base at Deception Island about November 1. From here Lincoln Ellsworth and Bernt Balchen plan to fly along the west coast of Weddell Sea to its head, thence, without stopping, across the Antarctic Continent to Ross Sea—a total distance of 2800 miles. Meanwhile the “Wyatt Earp” will make its way to Ross Sea and through the ice pack to the Bay of Whales, where it will pick up the aviators. Approximately 2000 miles of the flight will be over territory never before visited by man

The Proposed Route of the New Ellsworth Expedition



The plane ready to be
taken off the ship



Assembled on the ice shelf
beside the Bay of Whales



The ice unexpectedly breaks up. A group of men are shown trying to cross the rapidly widening cracks in an effort to save the plane, which appears in the distance at the right



Badly bent by the shifting ice, the plane ultimately is salvaged and hoisted aboard the ship



A crack opens directly below one of the plane's skis, damaging the running gear beyond immediate repair

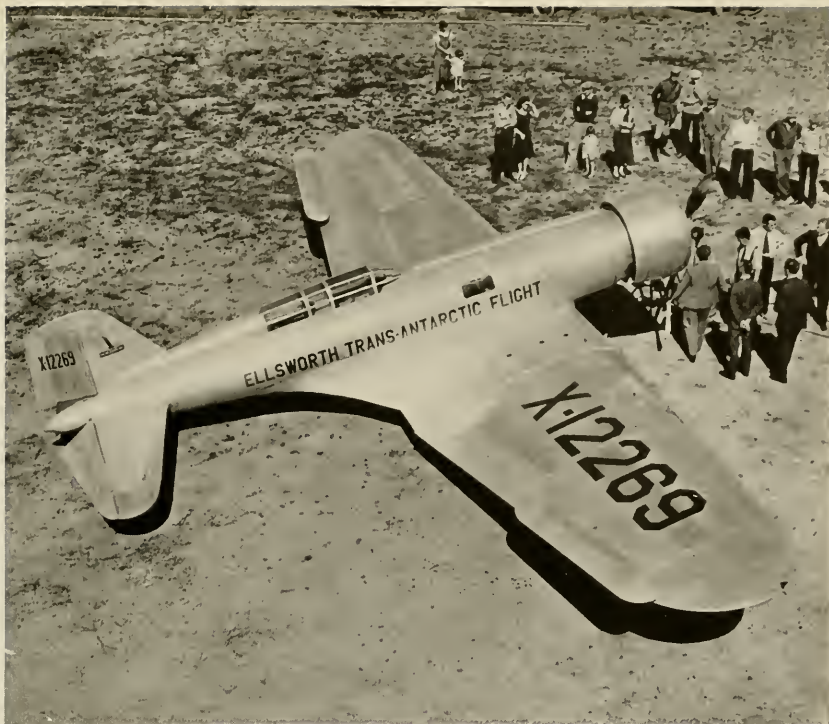
On the 1933-34 Expedition

A front view of the Ellsworth trans-Antarctic plane, showing part of the wing spread of 42 feet, and the front of its powerful 9-cylinder, 600-horsepower, air-cooled Pratt and Whitney motor. Fully loaded, the plane weighs 7500 pounds; empty, about one and a half tons. It has a maximum speed of 210 miles per hour, and on the trans-Antarctic flight must fly at a minimum of 150 miles for navigating purposes. It flies 8 miles on a gallon of gasoline. This was the first plane of its type



The Ship
The Plane
The Men

The expedition ship, the "Wyatt Earp," last summer carried the expedition plane from Norway to the Bay of Whales. This motor ship will play an important part in the new Ellsworth Expedition to the Antarctic this year. Above on the opposite page is shown the plane at the time of its test flights. Below are pictured Lincoln Ellsworth, leader of the expedition, navigator, photographer, and record keeper; and Bernt Balchen, pilot and radio operator for the flight



one cannot count on taking a ship through to the Bay of Whales until after the first of January. By that time it is past mid-summer. Clear weather is less common, and if one has not accomplished his work by the end of February, he must leave it unfinished or risk being frozen in for the long, long winter. Thus, working as we planned to work on our last attempt, we were definitely gambling, and the chances were far from being in our favor.

These, then, are the reasons for our new plans, for there is another possible way to accomplish our purpose.

THE WEDDELL SEA

Across Antarctica from the Ross Sea and the Bay of Whales lies the Weddell Sea, where conditions differ radically. It is true that Weddell Sea itself offers no possibility for a base, but to the north of Weddell Sea lies a great and complicated archipelago which for years has been visited regularly by whalers.

South Georgia, the South Orkneys, and the South Shetlands lie to the east and south of Cape Horn, with the South Shetlands forming a link that ties these islands to Graham Land, a part of the great Antarctic land mass. Here, in Bransfield Strait, lies Deception Island, which, for years, was a favorite headquarters for whalers. Of late years, it is true, the whaling base has been moved to South Georgia, 1100 miles to the northeast, but still the harbor of Deception Island awaits the person who would use it. Lying behind a narrow entrance, this harbor is from five to seven miles in length—the bed of an extinct volcano—and here are conditions such as an expedition could use to good advantage.

Naturally, I would prefer to make my base at the head of Weddell Sea, instead of 1350 miles away on Deception Island, for from the inmost reaches of Weddell Sea to the Bay of Whales the distance is only 1450 miles—a reasonably short flight

for such a plane as mine. But Weddell Sea has not often been penetrated. Only two expeditions have ever succeeded in reaching the head of the ice-crowded waters of this dangerous gulf.

Consequently, with Weddell Sea out of the question, I have decided to do the next best thing, and for that reason have chosen Deception Island. Furthermore, as is often the case, this very handicap serves a useful purpose as well, for between Deception Island and the farthest south known point beside Weddell Sea lies an area eight hundred miles in extent that as yet has never been visited by man.

Thus by flying from Deception Island to the head of Weddell Sea, and from there to the Bay of Whales, my flight will divide itself into two major portions, each of which provide all the unknown territory requisite to the purpose I have in mind. Then, too, the total flight is 2800 miles, as against the 2900 of my original plan, for I do not plan to return. Having reached the Bay of Whales, we intend to land and await the arrival of the "Wyatt Earp," which, from Deception Island to the Bay of Whales, will have a voyage of 2850 miles.

NEW PLANS

These changes in my plan will not necessitate a change in the organization, for both the ship and the men have been thoroughly tried out and have proved themselves all that could be asked for by the most exacting. As for the men, I never have known a finer or more loyal group, and while the ship is slow—she can make only six knots under power, and cannot surpass nine under sail and power both—she is a splendid ice boat, which is a vital matter in the Ross Sea.

The airplane that was damaged when the ice broke up beneath it in January is being rebuilt at the factory in Los Angeles, and will once more be in perfect condition before long. When it is ready,



This picture was taken at a time when the going was comparatively easy for the "Wyatt Earp." Twenty-two days were required to cover 487 difficult miles through the ice. During one four-hour watch, 157 signals were sent to the engine room, stopping, starting, and changing the speed of the engine

Through the Pack Ice





Ice Blink

The navigator in Antarctic waters is warned of ice ahead by the "ice blink," a streak of light in the sky which contrasts strongly with the darker sky over open water. If the ice is near by, the streak of light shows higher in the sky than is shown in this instance. By the same token, open water is shown by a darker patch or streak, difficult to describe, but more or less gray-lavender in color. A streak proving that ice lies in the distance is shown above the horizon at the left in this photograph which was taken at the entrance to the Bay of Whales. A great ice barrier looms close to the right of the "Wyatt Earp"



Antarctic Difficulties

The "Wyatt Earp" completely blocked by ice in the Antarctic Seas. Members of the crew seize the opportunity to survey their surroundings

The 403-ton ship bucking the stormy seas on the return to New Zealand early this year



The "Wyatt Earp" comes to the rescue of the men who were marooned on the ice shelf by water, when it so unexpectedly broke up



it will be shipped to Dunedin, New Zealand, where the "Wyatt Earp" is being overhauled, and in September we hope to be on our way to Deception Island.

FLYING EQUIPMENT

The plane upon which we are depending for the flight is undoubtedly the most interesting part of our equipment. Powered with a Pratt and Whitney supercharged motor of 600 horse power, she has a maximum speed of 210 miles an hour, and we must maintain a minimum of 150 miles an hour for navigating purposes. Incidentally, even with so powerful a motor and so great a speed, we are able to get eight miles to a gallon of gasoline, which cannot be exceeded by some of the larger motor cars of today. Furthermore, with her maximum supply of gasoline, she is capable of a flight of 7200 miles. With the necessary equipment for our flight, however, her cruising radius is greatly reduced—to 4200 if we use skis, but to 3200 if we are forced, as we expect to be, to use pontoons. Deception Island does not offer a flying field of dimensions great enough for us to take off equipped with wheels or skis. Consequently we expect to take off from the waters of the harbor, and it is for that reason that the pontoons will be used, despite their added weight.

Empty, the plane weighs about 3000 pounds. Loaded, her total weight is increased to 7500 pounds. Despite this great capacity, however, she will carry only two passengers—Balchen, who is to be the pilot and the radio operator, and myself, whose tasks consist of the navigating, the photographing, and the keeping of the detailed record. Thus, for from nineteen to twenty hours, Balchen and I will be busy every moment of the time in the tasks we have assigned ourselves, before we can reach the ice shelf and the open water of the Bay of Whales.

Despite the great power and high speed of the plane, which are necessary for the success of the proposed flight, the special flaps with which the wings are equipped make it possible for us to land at 42 miles an hour—a remarkably low speed. These flaps, too, aid us in taking off.

This forthcoming flight, then, which should take place in November, is truly a voyage of discovery over a gigantic ice-capped region in which no advance bases are possible. A successful flight will subtract a belt of the unknown from the blank map of the Antarctic regions. It will tell us whether or not Ross Sea and Weddell Sea are connected—it will tell us something more of the mountains and plateaus of the far south—it may tell us that the Antarctic "continent" is in reality two gigantic islands.

THE SOUTH POLAR CONTINENT

Antarctica is unique among the land masses of the world. It is the most remote. It is the loftiest of the continents, apparently being approximately seven times the average height of Europe. Its gigantic ice cap is seven or eight thousand feet deep, and yet, though it is still in an ice age of its own, its earlier conditions were vastly different. Within a hundred miles of the South Pole enormous coal seams have been found—seams a hundred miles long and forty feet thick, with fossil plant stems 18 inches in diameter, and fragmentary impressions of even larger trees.

Now is the time for the pioneer surveys of this great region. My interest does not lie in the Pole. My flight will miss the Pole itself by almost three hundred miles. But it is my hope to bring back an accurate survey of an 1800-mile route across a region never before visited by men, in order that, by that much, we may have a more complete picture of this fascinating sphere on which we live.

Chinese Turkestan

by

James L. Clark

Vice-Director, American Museum

“Sinkiang,” the land that
lies at the back of China

Photographs by the Author

Recently strange stories from Chinese Turkestan have appeared in the newspapers. In this region which “seceded” from China, an English pickle manufacturer, it was announced, had been chosen “king.” A faction, less than satisfied, objected, and a battle or massacre followed, with the loss, apparently, of thousands of lives. Because of these news accounts Doctor Clark was asked to write the following article, in order that our readers might more readily appreciate any further news that may come from this very distant and little known land.—THE EDITORS

CHINESE TURKESTAN—the very name is fascinating, but it is hard to conjure up a picture of what it really looks like, for few novels have told of its people, and practically no motion pictures have recorded its details as they have those of Africa and India. Thus it is difficult for most of us to create in our minds any clear concept of this land which lies so far back of beyond.

“Sinkiang,” as it is known in the Far East, lies in the geographical “Heart of Asia,” just beyond the so-called Roof of the World, which may be considered as the high Himalayas and the elevated plateau countries of Tibet and the Russian Pamirs to the east and west. From here all lands slope almost precipitously downward to the radial points of the compass. Here and there they may rise again, but never to the altitudes of these snowy wastes.

Topographically, this great central Asian basin, lying at about 5000 feet altitude, is protected by natural barriers on all sides. From the south and west the great mountain ranges rise like huge walls, half encircling it; to the north the steppes and interspersed lesser ranges spread far into Siberia; and to the east the seemingly endless desert of the Gobi rolls on and on to the Yellow Sea.

From any angle of approach it is a great trek by native conveyances or by one’s own caravan. It must take weeks and sometimes months before one can say, “Now I am in Turkestan.” And all of this, too, after days on trains up through India from the south, over Siberia from the east or west, or down into its lower western approach from Moscow, before one begins to near its borders. Far from its outermost edges modern transportation stops, and one must begin to arrange for some more simple way to proceed.

There are no Cook’s offices, aëroplanes, or automobiles, to meet you and carry you on, for as yet there is no supply of gasoline or suitable roads in the whole country, and all means of transportation but native carts, camels, horses, and yaks are left far behind.

Across the center of this almost circular land, from east to west, runs the magnificent Thian Shan, a great range of mountains which finally fades into the Gobi Desert. A more spectacular array of snow-clad pinnacles cannot be found. Named by the Chinese for their superb beauty—The Thian Shan, “Celestial Mountains”—they rise colorful and

Means of Travel

A camel caravan
leaving eastern
Turkestan, bound
across the Gobi
Desert



Native nomads on
their riding bul-
locks in a valley of
the Thian Shan



A mapa — the
“covered wagon”
of Central Asia.
These high-
wheeled carts are
widely used for
the transporta-
tion of freight and
passengers



A native pack
train passes the
toll gate in a bar-
rier wall across a
Thian Shan valley

A freight cart
goes aboard a
"ferry" in order
to cross the Aksu
River



Entering Turke-
stan over the Min-
taka Pass



gigantic from dusty, arid sands, glistening for miles upon miles against the sky, like the phantom of a promised land, luring the traveler to their tumbling streams, grassy meadows, and great spruce forests, while he toils in a bumping cart or astride a tired horse over the seemingly endless and scorching dust, his throat parched, his skin dry and dust-begrimed, his imagination carrying him on to those gleaming mountain peaks, as the otherwise monotonous landscape slowly passes by with hardly a change for days upon days.

THE TURFAN DEPRESSION

In the east central part of this country, almost in the shadow of Mt. Everest, which lies to the south, is the great Turfan Depression, which descends to more than 900 feet below sea level. In place of the water that once was there, great blocks of soda, cracked and piled up like a huge ice jam, now lie on its bed.

In these arid flats water is scant and far between. From the melting snows on these and the encircling mountains little streams converge into roaring, silt-laden torrents, which find their way out into the edge of the flat country, where they fan out and disappear as the thirsty sands immediately suck them up. Consequently, no streams of this whole great basin ever reach the sea.

Cities are only possible at the "mouths" of these constant streams, and therefore they are few.

As these rivers come from the mountains and fan out, they deposit a rich, alluvial soil, which in some places may be fifty to a hundred feet thick. Only here can habitations exist; first, because of a soil rich enough to grow crops, and second, because of a supply of water sufficient to maintain them.

Elaborate irrigation ditches dispense the water to the maze of fields tilled in this richer ground, where the cities are

definitely limited by the soil deposited on the barren sands and by the amount of water that can be had.

So it is that often an entire river is carried into the labyrinth of ditches, where it is dissipated by absorption and evaporation. When this point is reached, the increasing population, if it does increase, must find new homesteads.

Immediately at the edge of the cultivation the desert begins, and continues unbroken until a similar condition provides for another small community, or the plains give way to richer highlands, where a different life exists.

Here in the hills, where grass and water are more plentiful, we find the nomads with sheep, goats, cattle, horses, and yaks. In the southwest highlands they are mostly the Kirghis, a brown-skinned race with only a suggestion of the Mongolian. Here, also, we find a small group of Sarikoli, darker-skinned nomads who begin the transition into the tribes of northern India. Immediately we drop down from the great snow divides of the south, we begin to see the native *yurts*, those very warm and comfortable round, felt shelters of the Mongols, adopted and used by practically all the nomad tribes from Turkestan to Kamchatka and from Tibet to Siberia. Those who live in cities, of course, do not use them. Instead, they build adobe houses. In the north the Kazaks make a log house, like a good log cabin. They are a capable people who raise great numbers of horses in the fertile grasslands, and make *komiss*, the national intoxicating drink, from the mare's milk, which they allow to ferment.

WALLED CITIES

As in mediæval times, and for the same reason, all cities which are confined to the areas of the alluvial deposits of the lower flat country are enclosed in great walls made of mud. Wood is extremely scarce, coming from the trees of their

Chinese Turkestan lies in the very heart of Asia. Its inaccessibility is obvious from this map



Where the lands of Russia, China, and Britain meet. Chinese Turkestan is almost as large as the United States east of the Mississippi River

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The roofs of Kashgar

The People and

Yang Tsenghsin, governor
of Chinese Turkestan in
1926. He has since been
murdered



A typical nomad home being
erected by its owners. These
movable huts are merely
frames covered with felt mats



Khirgiz women—nomads of
the mountainous country
along the southern and west-
ern borders of Turkestan



A typical native house and garden on the outskirts of the city of Turfan

Their Homes

The British consulate at Kashgar—the “listening post” of the British Empire. This structure is built of mud bricks, but it is not typical of native construction



The dark-skinned Chantos of the Kashgar region, where they predominate



gardens, or otherwise transported on camels or bullocks for many miles from the forests of the mountains far beyond.

Each night, at sunset, the gates of the cities are locked, not to be opened until dawn, so the traveler, if he be late, must stay outside until morning. Only by very special order from the Totai, or local Amban, do they depart from this and permit any one to pass in or out. This, of course, is a relic of the past, but as they cling to other customs so they cling to this, and it still serves them as a protection in this land. No one lives outside the walls except bad men and outcasts, and as they are often desperate, they may prey upon those whom they find unprotected.

WAY STATIONS OF THE CARAVAN ROUTES

Outlying stations, "serais," like our old Pony Express stations, are the halfway houses where travelers stop en route between larger communities, and these are likewise protected by surrounding walls, which shelter those going both ways, but no one seems to trust the others within, for each and every one sleeps atop his chattels, and the gates are securely locked.

For the most part these way stations, which are along the few caravan routes of this country, are alongside well-holes or small streams, which may come from the ground only to disappear later on. Some of the wells are from fifty to seventy-five feet deep, dug, not where they find water readily, but where they must have it for man and beast. Often these stations are as far apart as fifty miles but they average perhaps twenty, if water can be found.

Nor is this water always good. Sometimes our supply from these deep wells was so limited that we had to ration it to animals and men alike and, in addition, so strong was it of alkali, that we drank only what we had to.

At times the midsummer heat was so very exhausting to our animals and our-

selves that we rested in serais by day and traveled in the cool of the night. Only in this way could we make the longer stretches between stations. For the most part our animals had to "feel" the road, such as it was, while we watched the stars for our general direction. Melodious, deep-toned bells on carts or camels told us the position of our winding caravan and told us, also, that all was well. Without them it would have been a very simple matter for the units to get separated in the dark and stray beyond hope of recall in the expanse and thirst of that desert before daylight.

The hundred-degree heat of the summer is replaced in winter by sub-zero cold, when the thermometer drops to forty or fifty below. Then, there is the "forty-day cold," as they call it, a time when the law, both written and unwritten, says that no one shall refuse shelter to a traveler.

CHINESE ADMINISTRATORS

The Chinese at the time of our visit in 1926, were in political control, and administered the government, keeping order with handfuls of soldiers recruited from the natives, while the ruling class, much in the minority throughout the whole country, held order with a tightened rein. With such a small force, they were of necessity most severe.

Politically, Chinese Turkestan is a hotbed of potential strife, where different people with different religions sway back and forth like surging tides, ever struggling for the upper hand, outwardly peaceful, but ever scheming for the time when they can win their cause.

Until the World War changed the form of governments, the southwest corner was referred to as "Where three empires meet,"—India, China, and Russia. It was the back door to them all, and it was, and still is, carefully watched by each to see that the other does not attempt a



Sunlight and Shadow

A Morden-Clark Expedition "mapa" passes through a small village. Here and there on the parched plains little villages such as this occupy the rare oases caused by some small stream or spring. Their advantages are few, but after the dust and heat and thirst of the desert-like plains they seem to the traveler to be places of extraordinary beauty and comfort



Bartering in Kashgar



A dilapidated Chinese fort
now used as a "serai"

City Walls

and

The Morden-Clark Expedition enter-
ing Karashar from the Thian Shan





The huge mud wall which protects the city of Urumchi

Entering Urumchi through one of the great gateways. The tower in the distance shows the Chinese influence



Native Bazaars

Market day in Kashgar



coup to seize any of the other's land, while he is busily engaged in affairs of state in his front yard.

A MILITARY PROBLEM

To maintain armies would be too expensive, but here a few handfuls of soldiers sit, each in their own corners, to see that the other fellow does not establish himself at strategic places along the great precipitous gorges, where they might balk for indefinite periods any attempt to dislodge them. With such a toe hold, they could prepare to sweep down on the country beyond.

China, unless the recent news from the East is more serious than seems likely at the moment, now holds Sinkiang, but only very loosely, for, like many of her provinces, it is a long way from Peking, and her control is remote, at best.

Its Chinese governors have administered the affairs of state much as they wished for their own profit and pleasure. They well know that if their superiors in Peking do object and wish to punish them, there is little danger. To send an army 2500 miles by caravan across the southern Kansu route would be a very difficult undertaking, and it would probably never get there, or at least, not for a very long time.

Once this was tried, in about 1868, and it took the army ten years to reach Urumchi, the capital. They moved in winter and grew crops and stock in the summer, robbing and slaughtering humans as they passed, and leaving only devastation in their wake.

In 1916 the Peking Government felt they should more thoroughly bring under their control the insubordinate outlying provinces. At an expenditure of a great deal of money and time and the experience of foreign engineers, they built a string of radio stations—one at Peking, one at Urga, one at Urumchi, and one at Kashgar. Now they thought all was well, as they could issue strict and definite orders

to their governors, but this did not work so well. If the governors did not like the orders after they received them, they just tore them up and said they never came through. These radio stations, which now stand and, as far as I know, are still working, are the only bit of modernism in this whole land.

The Governor, therefore, is supreme, a dictator with his eight Totais, or provincial heads, administering the provinces. Under these are the Ambans, or magistrates, who rule over the districts. These are all Chinese, educated and of the old school and fine chaps, too. Many of the younger men are college bred, from Peking or Shanghai, some speaking good English.

There are about six big cities in Chinese Turkestan—Urumchi, the capital, Aksu, Kashgar, Yarkand, Karashar, and Khotan. Urumchi, the largest, holds some 60,000 souls, while the others run 20,000 or less. Outside of these cities there are but few communities, for the reasons I have mentioned—lack of soil and water. Here and there one may find a very small one, made possible by a spring or water pan, but in between these and the scattered cities is a void waste of arid lands, often unknown and untraveled.

EXPORTS AND IMPORTS

Game and bird life, therefore, are very scarce, and the traveler must live on food purchased from the natives. As a consequence, little is raised in this country for export. From the sheep, goats, and few cattle, which are the main source of food supply, wool and hides are taken and sent north to Russia, which in turn sends back, principally, iron and muslin, sheeting, sugar, and tea, while other supplies for the Chinese are brought 2500 miles by caravan from Peking and Shanghai, having been exchanged for wool and hides taken to the coast.

Merchants predominate, and one wonders what they all do to keep so busy, but

At Kashgar



A Gateway in the City Wall

This gateway in the mud-brick wall of one of Chinese Turkestan's principal cities is an excellent example. Beyond the silhouetted group beneath the arch can be seen the second defense gate, erected in order to hold back any enemy that might succeed in passing through the outer portal. The mud bricks of which the walls are built are shown plainly about the arch



A Totai — one of the high Chinese officials of Aksu, with his son

The Rulers and

Cavalry and infantry as Chinese Turkestan knows them. These ragged troops are not highly efficient. In fact, they are largely the ne'er-do-wells of the country who join the army where they are usually fed, and are sometimes even paid



The Kalmuks
are almost pure
Mongolian



The Chantos,
of the south-
west, are re-
lated to the
Turks



These three peoples with the
Kazaks form the bulk of the
population of Chinese Turke-
stan. The Chinese, though
long in power, have never been
numerous, and other peoples
are in the minority

the

Ruled

The Khirgiz of the
southwest are the
nomads of the hills



they use many supplies from the East and West, making them up into native designs and garments, which we do not always recognize as something from without. As in all the Orient, the bazaars are fascinating. Storekeepers squat over small piles of spices, sugar, or local foods, awaiting someone who will buy even a little, but you never seem to see anyone buy anything, and you often wonder whether, should they sell the whole lot, they would be doing what you would consider a paying day's business.

Jewelers seem to predominate along the bazaars, making elaborately designed ornaments, earrings, and trinkets from silver wire. Blacksmiths not only shoe horses, but make pots and repair wagons and anything else in which iron is used. Most fascinating of all is the man who goes about with a little box, mending broken dishes. Artfully he drills a series of little holes near the broken edges, and fits into these holes perfect little metal staples, which so securely bind the broken pieces that the dish cannot leak, and except for looks, is as good as new. Personally, I think it has an added attractiveness with this applied exquisite craftsmanship.

A FRUITFUL LAND

The irrigated sandy soils, under the hot sun, produce wonderful fruits. Here is the land of apricots. We found them growing in every garden. Cantaloupes and watermelons were as delicious as they are at home, and tasted even better while we waited for our boiled drinking water to cool. Grapes, pears, and apples occasionally were seen, but were not as good as the melons.

The country is so old and the strifes so many that it is difficult to say just who originally belonged there. But today we

have the very dark-skinned Turkis, or Chantos, supposedly originating from the southwest toward Turkey. They have no suggestion of Mongol blood, and predominate in the southwest sector of Turkestan, with Kashgar as their center. They are the plains, or agricultural people. To the north there is a tribe of Kazaks, mountain nomads, with little or no strain of Mongol blood, but seemingly strongly Nordic—blue eyes, light hair, and skin as fair as ours.

A MONGOLOID PEOPLE

The Kalmuks are the other predominating people, strongly Mongolian, if not definitely so. They are the nomad horsemen of the grasslands and mountains. Other small tribes seem to be offshoots or phases of these three groups.

Peoples have invaded, fused, and separated, like wind-driven clouds, and the unscrambling of distinct groups is difficult.

There is a real future for this country. Surely, in these great mountains there must be vast stores of minerals. Urumchi is supplied with coal dug from the surface twenty miles outside of town.

In the Tekkes Valley of the Thian Shan there are great forests and thousands of square miles of grazing land and fine agricultural lands. This section alone, which has a temperate climate, could support a nation of people, for it is self-contained, with all requirements.

Turkestan approximates our Southwest—deserts and plains which run up into bountiful mountain ranges. Planes and railroads and roads will gradually come in from the north and northwest, and as soon as that happens, the country will develop.

There is here, then, a vast amount of good land to absorb people, and it is a "white man's" country.

The Kingdom of the Tides

By

Roy Waldo Miner

Curator, Living Invertebrates
American Museum

WHEN we look at maps and charts, we see the boundary between land and sea marked by a definite line, but if we search for its exact location as we stroll along the beach, we cannot find it. The incoming waves rush up over the sands until they flatten out, lose their momentum, hesitate, and stream back into the flood whence they came. As the tide rises, the sea gradually advances farther inshore, but finally a limit is reached at high water. At certain seasons, and at times of storm, a greater area of land is covered, but the recession always takes place and the territory won by the ocean is abandoned, until, at the very lowest ebb, a strip of sea-bottom, in turn, is conquered by the land.

The strand slides under water at the same general slope, and, though diversified by sand bars and shoals, the sea-bottom sinks at a uniform rate, until, at a greater or less distance offshore, at a depth of about six hundred feet, it dives at a more rapid gradient into the depths of the sea. Here, at the edge of this steep slope, is the first indication of a line of separation. It is said that, ages ago, the real boundary of the land was to be found here, and the continents were much larger. Now the seas have flooded over the edges of this ancient land, forming a comparatively shallow border or rim, varying in width from thirty to one hundred miles, which we call the continental shelf.

This shallow area, well lighted by the sun, and warmer than the oceanic deeps, is the real theater of the life of the sea-bottom. In the sunlight the sea-plants, or algæ, abound, and feeding among them are myriads of small oceanic creatures,

which, in turn, form the food of the larger inhabitants of the sea.

Here are gathered living hordes of fishes, mollusks, crustaceans, sea-worms, echinoderms, and the lower forms of life. From this shallow zone, in the course of time, many species have invaded the deeper waters and have become adapted for the dark abysses beyond the edge of the continental shelf. Myriads of others have crowded into the warm, sun-lit shallows near the shore and have even sought the intertidal stretch which is laid bare twice daily by the ebbing tide.

As we walk along the shore at low tide or wade in the shallows, we invade the edge of this teeming world of sea-creatures and see many signs of their activities. Along our coast from New York to the Bay of Fundy, the aspect of the ocean margin presents many contrasts. Long Island and Connecticut are characterized by stretches of exposed sand beaches, sheltered mud flats and sand spits. Here and there may be found out-croppings of rocks or tide-rips where glacial boulders have been laid bare, but the chief character of the coast is low and free from rock. This condition becomes intensified as we reach and round the curving arm of Cape Cod, which is nothing but a huge sand spit. North of Massachusetts Bay and Boston, bold headlands of rocky cliff jut out into the sea, as at Nahant, Marblehead, Gloucester, and Cape Ann generally. Along the coast of Maine, high, rocky cliffs become the rule, lining and limiting deep bays, sown with jagged islands, and hemming in the estuaries of great rivers.

The height to which the tide may flow

Sea Shore Warfare

The five pictures at the right show, first, a colony of oysters on a mud flat. The second picture shows a mass of invading mussels which, in the third photograph, are pictured after they have overwhelmed the oysters. The fourth view depicts the mussel colony being invaded, in turn, by barnacles which, in the fifth view, are shown completely victorious





A barnacle extending its feathery feet from its limestone wigwam

Creatures of the Sandy Beach



At the left on the opposite page are two pictures of *Natica*, the sand collar snail, which hides in mound-shaped burrows or crawls over the sand, pushing its fleshy apron before it. Next comes a lady crab up to her eyes in sand; a "sand bug" preparing to "dig in"; a rock crab, and finally another lady crab showing its paddle-shaped hind legs

shows great variation. Along the exposed sandy shores of southern New England it ranges from two to five feet in height, except where the incoming seas are forced into narrowing bodies of water like Long Island Sound, where it rises six to seven feet, as at New Haven and Bridgeport.

HIGH TIDES AND LOW

On the outer side of Cape Cod, the rise is but two feet, but the masses of water that crowd into Cape Cod Bay reach nine feet at Plymouth. North of Boston this height continues, becoming gradually increased along the Maine coast. The Gulf of Maine is a huge, curving and tapering funnel, guarded by Cape Cod to the southward and the peninsula of Nova Scotia to the northeast.

The tides entering this huge gulf are shunted along the hollow curve of the Maine shore line and Bay of Fundy, rising at high water eighteen feet at Bar Harbor, twenty-eight feet at St. Andrews, New Brunswick, and the enormous height of forty-five feet during spring tides at Amherst and Truro, where, at the double apex of the funnel-shaped Bay, the Nova Scotian isthmus ties the peninsula of that name to the mainland of North America.

Naturally the combination of high, swift-running tides and rocky coasts has a far-reaching effect on the animal and plant life inhabiting the impetuous waters of northern New England, compared with the low-lying, quiet, sandy and muddy coasts of the more southerly portions.

The temperature of the waters in the two regions also is of great influence. Southern New England is washed by spurs from the warm waters of the Gulf Stream, especially in the Cape Cod region which, with the outlying Elizabeth Islands, as well as Marthas Vineyard and Nantucket, juts boldly out into the sea. But farther north, the cold Arctic Current pushes its way in close to the shore, and creatures which, in southerly waters, are

found only in the deeper, colder seas, here occur near the surface and are able to live in shallow waters near the rocky shore.

If we could stroll along the entire New England coast in a few hours, we should find ourselves passing over regions continually changing in character, and the species of animals populating the shallow waters around the low-tide limit also would be seen to vary in harmony with the changing environment. The forces of inanimate nature sift out all individuals that invade regions to which their bodily structures and habits are not adapted.

As it is out of the question to cover so much territory in one journey, let us transport ourselves in imagination from place to place and sample a number of contrasting typical localities to become acquainted with the shallow-water animals characteristic of them.

AN EXPOSED SANDY BEACH

The white sand stretches out before us for miles, heaped high into dunes at our left or extending over into broad flats covered with beach grass and low shrubbery. At our right, the surf breaks thundering on the shore, washing to our very feet and bringing quantities of loose sand along with it. Here and there, with a rattle and a roar, the waves bombard the coast with masses of rounded pebbles, spreading them over the strand in assorted sizes ranging from gravel to bowlders.

We pick up dead and empty shells on the beach, many of them broken and beach-worn. Ruffled fronds of kelp are washed up and other flotsam from the sea, but, for the most part, life is conspicuous by its absence, and the sandy shore seems barren indeed. This is not to be wondered at. The shifting sand gives little opportunity for harboring animal life which otherwise might burrow within it, and the force of the waves transforms into grindstones the pebbles and rocks which, in quieter waters, would give

shelter to all sorts of sea-creatures. The siliceous sand grains are barren of food material and could support no life even if any could find foothold among them.

Nevertheless, at the upper tide limit, long lines of beach wrack mark the boundary of the ocean's surge, and as we stir up the decaying and drying fragments of seaweed, swarms of beach-fleas (*Orchestia agilis*) come to life and jump hither and thither in clouds. If we are quick, we can capture them and put them into a glass jar, where we can examine them at leisure. They are olive green in color. Now, as we look closely at the sand not far from the high-tide mark, struggling forms emerge from tiny little holes that are almost invisible, and go leaping about, their grayish, sand-colored bodies closely resembling their environment. They, too, are sand-fleas of two different species (*Talorchestia megalopthalma* and *longicornis*) somewhat larger than their green brethren and distinguished by unusually large eyes and long feelers, respectively.

THE LADY CRAB

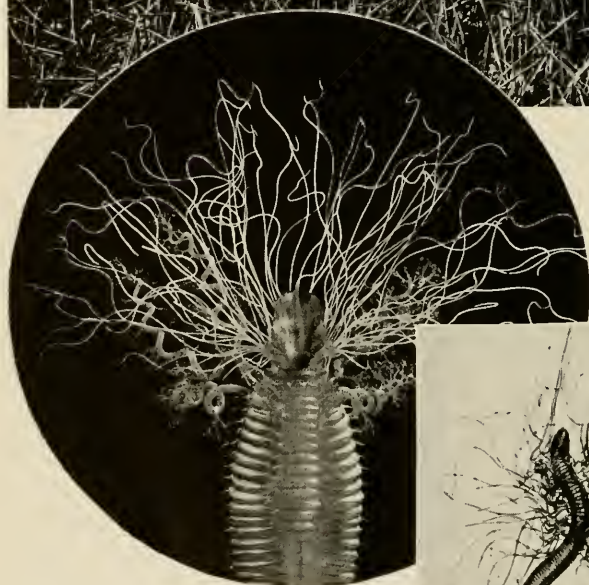
At low tide, when the sea is calm, one may wade in the shallows with a water glass and find other evidences of life. Yonder a lady crab (*Ovalipes ocellatus*) goes swimming by sidewise, waving its paddle-shaped hind legs over its back as a means of propulsion. A short distance away it settles down on the sea-bottom, raises its stalked eyes, and regards us warily. We approach with stealth, to get a good view of its carapace gayly spotted with irregular purplish pink dots, and the sharp pincer-like claws, striped also in purple and pink, which wave menacingly toward us. It is all a bluff! For as we cautiously wade nearer, the crab shoves the hinder margin of its carapace down into the sand, and rapidly digs itself under till only the frontal edge, the ends of the stalked eyes, and the waving, threadlike antennæ are visible.

The rock crab (*Cancer irroratus*) is also abundant here, scuttling over the sandy floor, as it has no paddles to swim with like its more fortunate cousin. We catch glimpses of the slender almost transparent boatlike bodies of the common shrimp (*Crangon vulgaris*) darting here and there like phantoms.

SAND-COLLAR SNAILS

A number of sand-collar snails of two species (*Natica heros* and *duplicata*) have started a settlement yonder where the sandy floor is nearly level and is laid bare only at the lowest tide. Low, rounded mounds scattered over the wet sand betray their habitat, and, as we watch, there is a disturbance in one of them which is still under water, and we see a round, almost globular shell, about as large as a tennis ball, break through. A fleshy foot protrudes itself from the shell opening and extends forward and back over the sand until it seems impossible that so much animal could be packed so tightly within the spire of the shell. Now it begins to travel forward, pushing before it an apron-like flap, above which waves a pair of antennæ, each with an eye-spot at its base.

As the creature slowly progresses, a transparent, jelly-like ribbon emerges from under the right side of the apron and is slowly pushed around the lower margin of the shell, where it is overlapped by a fold of the broad, fleshy body. Soon it completely surrounds the shell like a border. The snail continues to creep forward and leaves the transparent ribbon behind it on the sandy sea-floor. The sand washes against it and sticks to it. We pick it up and find it is a delicate little collar-shaped arrangement, open in front and slightly ruffled at the lower margin. The sand which has stuck to the outer surface covers it in a single layer, giving it an appearance of fine sandpaper. If we examine the under side with a hand lens, we find that it is entirely lined with a



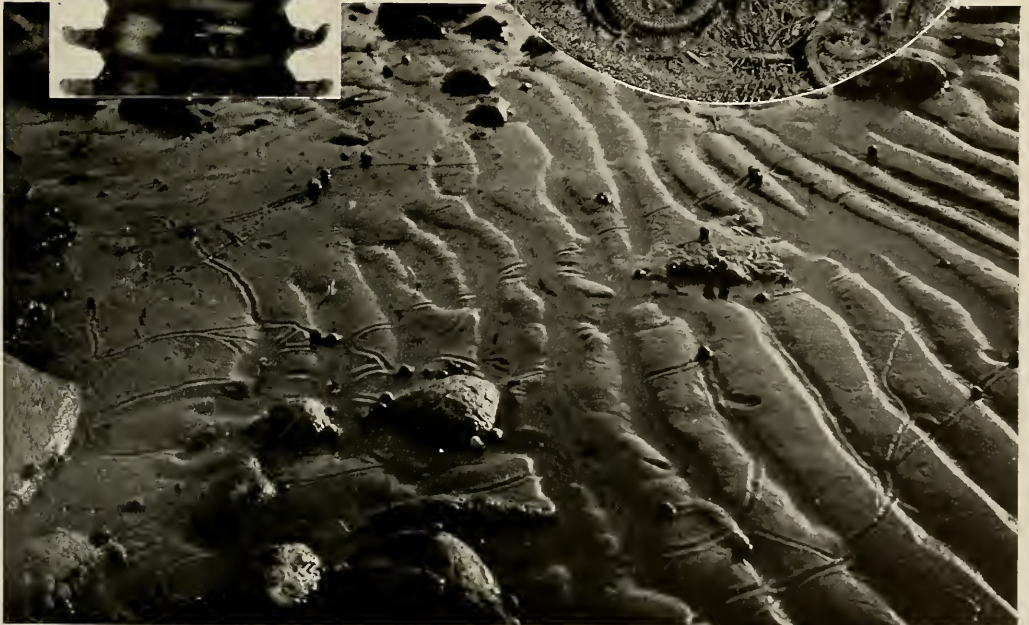
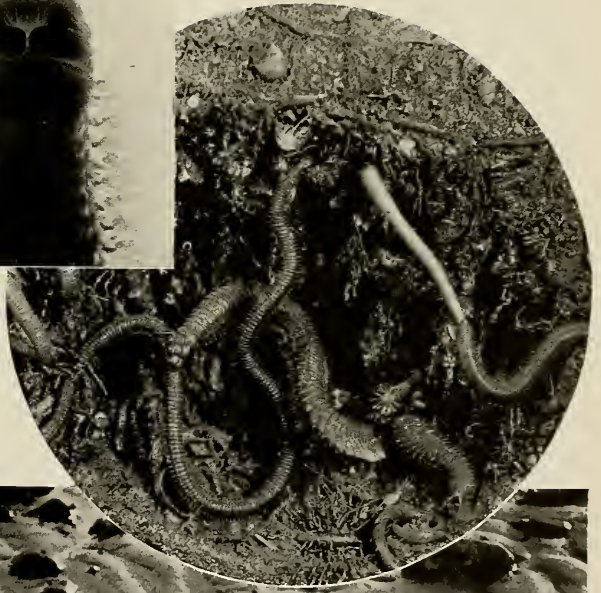
Tidal Water and Marsh Grass

In settings such as the one shown at the top of the page, fiddler crabs dig burrows among the grass roots.

The sectional view above at the right shows a fiddler-crab burrow, together with a starfish preparing to feed on an oyster. Marvelously adorned seaworms dig in the mud, as well. In the circle the ornate worm (*Amphitrite ornata*) spreads its delicate tentacles; in the center rectangle a fringed worm (*Cirratulus grandis*) extends its threadlike filaments; at the left is pictured the head of a plumed worm (*Diopatra cuprea*). Except for the view at the top, these photographs are of models at the American Museum

A Ripple-Marked Mud Flat

Prolific sea worms make their homes and dig their subways in the tide-washed mud. In the circle, a clam worm (*Nereis*) appears to be attacking an opal worm. At the upper right a trumpet-worm model is shown, surrounded by the sand grains that it has built into a home. The center rectangle shows a model of the head of a "beak thrower," pictured also in the circle "throwing its beak." Below at the left the head of an opal worm is shown, gleaming with iridescent hues. The tracks shown crossing the ripple marks in the bottom picture have been made by black mud-snails



delicate layer of transparent eggs, each like a tiny bead of jelly, all closely set together in a finely wrought mosaic. As the collar dries in the sun, it becomes so fragile that it crumbles to sand in our fingers.

We now turn our attention to the snail itself and see that it is rapidly creeping through the shallow water toward a group of little flattened sticks standing up from the sand at an abrupt angle. The snail seems much interested in them. As we examine them with attention we see that their sides are formed of two long, narrow, slightly curving shells which somewhat suggest the size and shape of the old-fashioned razor handle. We recognize the razor-shell clam (*Ensis directus*). The shells stand half-buried in the sand, showing the ends of their short siphon-tubes at the top bordered with fringelike papillæ. Apparently they are aware either of us or of the approaching snail, for suddenly first one, then another, shoots down into the sand until the siphon-openings are barely even with the surface. They are great diggers, for their lower end is equipped with a powerful curved and tapering foot, which is used as a very efficient digging organ.

These inhabitants of the exposed sandy beaches, together with certain others, such as the soft clam (*Mya arenaria*), the surf clam (*Spisula solidissima*), the "sand bug" (*Hippa talpoida*), the sand dollar (*Echinarachnius parma*), and a few sea-worms, are able to endure the difficult conditions of exposure to the open sea. Most of them also occur in the more sheltered regions described below, but they are the hardy explorers of the shallow seas, and form the scattered population of a region which is otherwise without abundant visible life.

SHELTERED SAND AND MUD FLATS

As we walk along the beach, we may find our progress stopped by an inlet through which the tide flows into more

sheltered waters. In such places the currents wash the sand and mud away from the bowlders embedded therein and much of the mud is carried into the sheltered waters of the bay, to be deposited upon its floor, mingled with sand to a greater or less degree.

AMONG THE EELGRASS

This mud is filled with nutritive material in which eelgrass grows readily and which also provides sustenance for all sorts of burrowing sea animals, and many others which lurk among the weed. Hosts of tiny creatures grow on the eelgrass blades, hide under the stones in the bottom and edges of the tidal channel, and cling to the seaweeds growing in such places.

Depending on the amount of exposure to the open sea, the soil grades from gravel, through sand, sandy mud of various degrees of admixture, and pure mud, abounding in inhabitants which thrive best in each special environment as well as those ubiquitous creatures which range over the whole field.

The little hermit crabs (*Pagurus longicarpus*) are among the latter. These may be seen scuttling back and forth in shallow water. They are small shrimplike creatures with a pair of heavily armored, formidable claws and four spiny walking legs, but with a soft, tapering abdomen which is their weak point and is entirely unprotected. Attached to this are a few pairs of small holding claws. To make good their deficiency, the hermit crabs appropriate abandoned snail shells, backing their soft abdomen into the spiral chamber of the shell, into which it neatly fits. They hold the shell in place by gripping the central columella of the spire with their weak abdominal claws, and then boldly run around with their castles on their backs. If assailed by an enemy, they retreat within the shell, closing the opening with one of their large claws. However, certain species of fish eat them, shell

and all. The hermits are the scavengers of the shallow seas and always gather together in great numbers to feast upon dead and decaying plants and animals. On muddy bottoms they are joined by the black mud snails (*Nassa obsoleta*), whose progress over the mud can be traced by their undulating groove-like trails.

A POPULOUS CITY ON A SHELL

The hermit crab is also interesting, because, in many cases, the dead shell that it carries may become covered with a soft substance appearing at first glance like the pile of coarse velvet. If we place such a crab in a small dish of sea water and look at it under a magnifying glass, this covering resolves itself into a city of tiny hydroids (*Hydractinia echinata*), little flower-like creatures with slender tube-shaped bodies, some of them with terminal mouths surrounded with grasping tentacles; others with no mouths but carrying quantities of egg-producing organs looking like tiny clusters of grapes; and still others near the edge of the shell with no mouths, but with their heads crowned with beadlike batteries of sting cells. Obviously this is a community of specialists, some members of which are the feeders for the colony, others, the reproducers and nursemaids, and the rest the fighters. Each has its special work to do. All the individuals are connected by a network of tubes, so that food may be supplied to the members that have no mouths by those which secure and digest it.

Larger species of hermits (*Pagurus bernhardus* and *pollicaris*) hide in the eelgrass, where also may be found the great whelks (*Fulgur canaliculata* and *carica*), which bear large, coiled shells on their backs with a pointed siphon in front. The females of these whelks manufacture egg-strings, two or more feet in length, looking like strings of spiny, yellow pill boxes, in which the eggs hatch into baby snails with tiny shells like those of their

parents. After a time the little snails emerge from a hole in the edge of each pill box and take up an independent life. The whelks prowl around, in the hope of capturing one of the scallops (*Pecten gibbus*) which abound in the eelgrass. This is a game of stalking, for the latter possess a hundred or more gleaming, steely blue eyes around the edge of the mantles, and, when alarmed by a shadow, will spring up in the water and flit out of the way, opening and closing their shells rapidly as a means of locomotion.

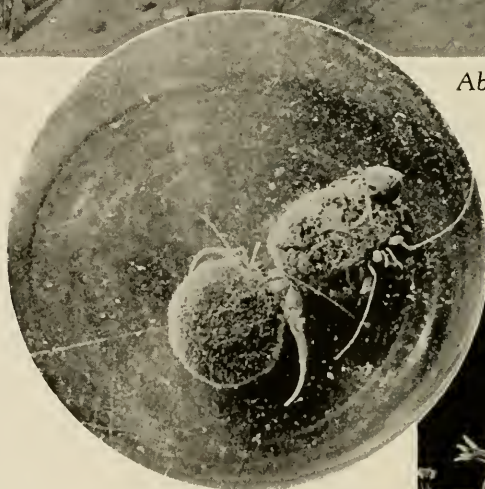
The green crab (*Carcinides mænas*), conspicuous with its bright green, yellow, and black markings, and the blue crab (*Callinectes sapidus*), familiar to us in the markets, frequent the sheltered mud flats in shallow water, while the small mud crabs (*Panopeus herbstii* and *sayi*) with their black-fingered claws are everywhere at the water's edge. The large spider crabs (*Libinia emarginata* and *dubia*), with their long legs and small, spiny, rounded carapaces, hide in the eelgrass and are hard to see on muddy bottoms.

OYSTERS AND MUSSELS

On mud-flats laid bare at low tides one may chance upon occasional oyster beds, though these are usually cultivated at some depth. More frequently huge flats may be covered with edible mussels (*Mytilus edulis*). These black mussels are a potential article of food, now much neglected, but, when properly prepared, they rival the succulent oyster and little-neck clam in delicacy of flavor and nutritious value. On Marthas Vineyard Island, literally acres of mussels are laid bare at low tide. They multiply so rapidly that, if by chance they come in contact with a bed of oysters, they will overspread it and completely smother it. The rock barnacles, in turn, reproduce even faster than the mussels, and, by sheer force of numbers, given an opportunity, will invade a mussel colony and overwhelm it,



Above: A giant whelk pursues a scallop, which swims by opening and closing its shell



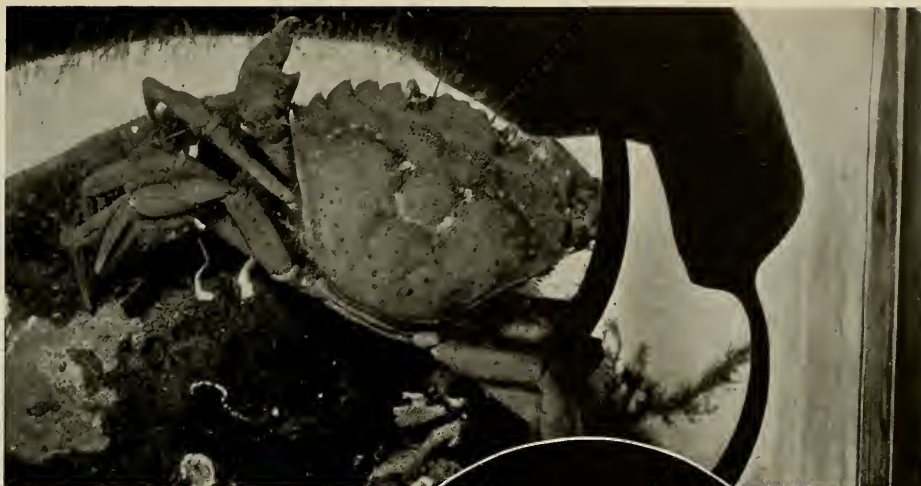
Below: The "velvet" on the hermit crab's appropriated shell is shown, in an American Museum model, to be made of three types of tiny hydroids—fighters, feeders, and egg producers



Above: A hermit crab in his borrowed and "velvet"-covered shell

Below: The familiar edible blue crab





Above: The green crab above is not edible, but is a pugnacious fighter

*Photographs,
M. C. Dickerson*

Below:

A spider crab, which has camouflaged himself by plucking tufts of Bugula and placing them on his back



A rough-spined spider crab, which has lost one claw



Below: A lady crab is shown swimming vigorously in an attempt to escape from a lobster



thus rendering poetic justice to the former conquering horde.

ENEMIES OF MOLLUSKS

These beds of shellfish, of course, attract the enemies of bivalve mollusks in great abundance. The most important of these are the oyster drill (*Urosalpinx cinerea*) and the common sea stars (*Asterias vulgaris* and *forbesi*). The former bores neat little pinholes in an oyster shell, and sucks out the contents, while the latter mounts the oyster, applies the pneumatic disks of its tube-feet to the two valves, and, bracing the tips of its arms against surrounding objects, pulls the shells open by main force and proceeds to devour their contents.

The oysters are not naturally found in muddy localities, but have been transplanted there by man, by spreading shells to form a "clutch." They belong more properly on a rocky bottom.

The animals most typically associated with more or less muddy regions are the sea worms. Burrowing in the soil everywhere, they construct tubes of greater or less consistency, or, in some cases, no tubes at all. They hide under flat stones, or dig among the roots of eelgrass. In localities rich in mud the fringed worm (*Cirratulus grandis*) burrows in great abundance, its reddish body adorned with a multiplicity of long, threadlike, breathing organs on the forward third of its body, each filament of golden yellow with a brilliant red thread of blood showing through the translucent walls. The plumed worm (*Diopatra cuprea*) constructs tough, parchment-like tubes in sandy mud, showing like chimneys above the sea-bottom, to which bits of shell and seaweed are cemented. The worm has a bluish iridescent body equipped on the forward part with marvelous blood-red plumes with spirally arranged branches. The ornate worm (*Amphitrite ornata*) builds tubes of sand and mud. It is a

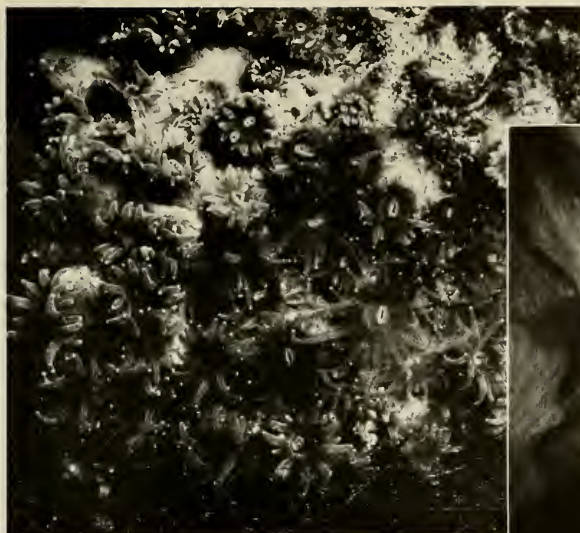
wonderful creature with three pairs of intricately branched gill-plumes on its shoulders and numerous flesh-colored tentacles extending in all directions from its head. Its body is beautifully marked with reddish brown, and a broadly tapering upper lip is colored from rich rose to violet. The opal worm (*Arabella opalina*) has an orange head with four eyes, and a long, slender body composed of brilliantly opalescent rings. The trumpet worm (*Pectinaria belgica*) digs with a pair of golden combs and constructs a trumpet-shaped tube of neatly matched sand grains arranged in a delicate mosaic.

Scores of other species occur, all remarkable for beauty, grotesqueness, or strange habits, but it is impossible to mention them all here. Needless to say, the sheltered mud- and sand-flat is one of the most fruitful fields for the study of the strange creatures of the sea.

ROCKY SHORES AND HIGH TIDES

Let us now transport ourselves to the north shore of Massachusetts or the coast of Maine. We are on a rock-bound coast, hemmed in by high cliffs, against the base of which the incoming tide breaks in masses of foam, which scour through every crevice and rush back into the sea. The tide rises and falls nine feet or more, according to the locality, and, farther north, several times that distance.

At low tide the vertical walls of the cliffs are seen to be broken into shelving terraces, draped and festooned with rock-weed, bordered above with a long frieze of white barnacles. The basin-like hollows on the rocky terraces are filled with water, even when the tide is at its lowest, and each one glows with submerged colors like an aquatic sea-garden. There is no soil for burrowing like that on sand- and mud-flats, and all animals having no adequate clinging organs, or requiring a soft substratum for burrowing are eliminated here by the force of the elements, and yet



Left: The only coral (*Astrangia danae*) of the New England coast is shown growing over a rocky bottom



Above: A sea anemone (*Metridium marginatum*) expands its feathery crown, which is armed with sting-cells with which it slays small fish for food



In the small rectangle a common starfish (*Asterias vulgaris*) is portrayed. Below: A starfish is shown attacking a small fish. The "tube-feet" are equipped with sucking discs by means of which the fish is dragged into its attacker's central mouth





The rocky coast at low tide. The white band is made up of barnacles. Below these, festoons of rock weed partly cover crowded masses of mussels. In the water, starfish and green sea urchins abound

Right: The little red sea star (*Henricia sanguinolenta*), which is abundant in the tide pools of rocky coasts. Photograph by M. C. Dickerson

Below: A view looking through the clear water of a pool replete with Irish moss, coralline dulse, kelp, rockweed, and sponges



Seaweed drapes the rocks of a beautiful pool at Nahant, Massachusetts. In these clear, quiet waters are displayed a magnificent sea garden in which the observer may find a rich field for observation



Left: Purple snails (*Thais lapillus*) are shown feasting on mussels. These snails produce a beautiful purple dye similar to the ancient Tyrian purple. A cluster of eggs is also visible

Below: A corner of the Nahant pool showing green sea urchins, sea stars, and green crabs on the coralline covered rocks



certain creatures familiar to the southern shores adapt themselves to these trying conditions and survive.

BLACK MUSSELS AND PURPLE SNAILS

The same kind of black mussel (*Mytilus edulis*) that covers the mud-flats of the southern coast to so great an extent, clings to the rocks in broad bands below the barnacle zone and underneath the rockweed, but, in exposed situations, the shells are always very small, for when they reach a size to present resistance to the force of the waves, the silken strands of their tough byssus threads give way and they are stripped from their anchorage by the rushing water. They also must dispute their territory with the purple snails (*Thais lapillus*), which cluster in numerous colonies and feed on the little mussels. These snails derive their name from the fact that they exude a purple fluid, allied to the Tyrian purple of Mediterranean snails. Their shells, however, are gayly banded with red or yellow spirals, or the entire shell may vary from white, through orange, red, and brown. They lay their eggs in little pink or yellowish vase-shaped capsules, which stand on slender stems and are grouped together in small patches in the crevices of the rocks.

At low tide multitudes of sea stars familiar to the southern shore (*Asterias vulgaris*) but varying greatly in color from purple, through blue, crimson, and yellow, feed on the mussels and on the little green sea urchin with the long scientific name (*Strongylocentrotus drochbachiensis*), which is very abundant here. Another sea star characteristic of rocky coasts is a small, deep-red species (*Henricia sanguinolenta*), bright yellow beneath and at the tips of its curving arms. The Jonah crab (*Cancer borealis*) is very common, crouching and hiding in rocky dens. It is larger and with much rougher carapace than the rock crab of Southern New England (*Cancer irroratus*), which also is

found on the northern coast, but more sparingly.

The tide pools on the terraces show remarkable concentrations of sea life. As the sun slants through one of these flooded basins at low tide, it lights up tangles of rich brown, brilliant green, purple, pink, and red algæ, their graceful fronds clustering and overarching miniature vistas, in which acorn snails (*Littorina litorea*), green crabs (*Carcinides mænas*), and tiny red or variegated chitons (*Chiton ruber* and *apiculatus*) creep about amid fairy clusters of pink-hearted hydroids (*Tubularia crocea*), gray-green chimney sponges (*Hali-chondria panicea*), and pink finger sponges (*Chalina oculata*).

SEA ANEMONES AND SEAWEEDS

Sea anemones (*Metridium dianthus*) expand their broad, flower-like, fringed disks, and cylindrical bodies, brown, pink and white, and bright orange in color. Even the rocky basin itself is enameled with encrustations of red-purple *Melobesia* and brick-red *Lithothamnion*,—calcareous seaweeds, that spread thin, stony layers of color over the underlying rock. Clusters of huge horse-mussels (*Modiola modiola*) covered with purple and red bryozoa, open their shells slightly, exposing their orange-colored mantles.

It seems impossible that there should be such an abundant association of living forms in so small a space, but the secret lies in the flood of aerated and food-laden waters that twice a day overwhelms these tidal pools and brings the inhabitants everything on which their life depends.

These associations of the animal life of the seas, whether on sandy shore, mud-flat, or rock-bound coast, are but glimpses of an almost infinite kingdom of creatures under the rule of the tide, which sweeps over the great oceanic shelf, bringing life or death to its subjects, depending upon how they adapt themselves to its laws.

How the Papuan Plans His Dinner

by

Margaret Mead

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An account of the mountain Arapesh of New Guinea, who, in spite of a meager food supply, have built up a social system in which each man works happily so that his neighbor may eat

A GREAT many theories have been developed upon the relationship between food and civilization and between food and temperament. Popular conceptions of the way in which the savage manages his food supply present striking incongruities. There are those who believe that the savage lives a life of idyllic laziness, lolling beneath breadfruit trees from which pre-cooked and well scraped breadfruit fall into his open mouth at stated intervals. In direct contrast to this day-dream picture of the South Seas, is the idea of the savage, cowering gaunt and unclothed beneath an overhanging cliff, gnawing an uncooked bone. In the face of such contradictory conceptions, it is of interest to investigate the way in which a primitive people really do plan the cultivation and distribution of their food supply.

The mountain Arapesh of New Guinea live on very poor land. The precipitous mountain ridges provide little level garden space; torrential rains followed by landslides devastate the gardens perched so precariously on the steeps. The top soil is thin and infertile and the natives know no method of fertilizing; each year a new piece of bush is partly cleared by cutting down the small shrubs and lopping off the branches of the tall trees, so that a garden presents a ghastly contrast between lush new vegetation below and stricken, limbless trees towering palely above. As their mainstay, the Arapesh depend upon taro, a tuber with a waxy, stringy consistency which tastes at first a little like soap. Taros are of two kinds, those which will keep like good potatoes in a cooler climate (of these the Arapesh have very little) and those which keep only a few

days and which must be replanted from the cut green shoots before they have withered. This means that for their chief carbohydrate dependence the people are always hurried, digging a small supply of taro, hastening to plant back the shoots before they wilt away and are lost.

TEMPERAMENTAL YAMS

There is also the yam, a tougher tuber, requiring more care while it is growing, for the vines must be trained and tended, and subject to far greater hazards, as a promising looking yam garden may yield no yams beneath the ground. The natives think of the yams very personally; if in the middle of harvest, the harvesters are called away, the yams get sulky and disgruntled and slip away into the woods and are lost, so that the yam-digging stick meets only empty, yielding earth. Yams will keep for months, finally going bad and sprouting in the store houses of the too dilatory, but for feasts for which one must plan in advance, or at which it is the fashion to give the guests uncooked food to take home with them, yams are best. Yams are men's work, as taro is women's, and yam planting and yam harvests are accompanied with much magic and ceremonial.

Third among the vegetable foods of the Arapesh is sago, the pith of the sago palm. Sago is scarce among the mountains; there are no natural sago swamps, every tree has to be planted, and it is customary for a father to plant sago trees for each son. He also plants cocoanut and betel palms so that each child will start life with a capital sufficient to last him his lifetime and enable him to take part in the life of the community. In the gardens are also planted bananas, sugar cane, and several varieties of greens which resemble Swiss chard and which are an essential part of every Arapesh meal.

For protein, they have to depend upon hunting and upon domestic pigs. The

pigs are a sad race of razor-backed animals, meager creatures that are always coming to grief, being strangled by snakes, taken by hawks, or falling into traps which have been set for some wild animal in the bush. Raising a domestic pig is a difficult business and one at which some women never become adept, in native phrasing either "because they are so greedy that they eat up the very parings of the yams and leave nothing at all for the pig" or "because they are so careless that they can forget their pig for a whole day." The small pigs, which are usually petted and pampered like lap dogs and spoken of as "children," are even credited with dying of sulkiness if suddenly neglected. A man whose wife has repeated losses of the pigs which have been entrusted to her to feed, will finally serve public notice upon her that her days of pig feeding are over forever, by setting up a pig-feeding moratorium sign outside her door, a spear stuck in a pig trough of bark, with half a yam tied to the top. This is a great disgrace. A man speaking reverently of the great abilities of his grandmother or mother will mention, high in the list, that she had a great way with pigs.

DIFFICULT HUNTING

Hunting is a hard and unrewarding task among hills which have been populated by a hungry people for hundreds of years. The Arapesh use dead falls, and traps; they build shelters and hide in them all night, waiting for an unwary wild pig to venture into the baited enclosure; they make rope snares for tree kangaroo and cassowaries and shoot wallabies and opossums with bows and arrows. After a heavy rain they occasionally find a few fish in the streams. Small boys learn to trap rats and bandicoots and to sit patiently holding one end of a bird's snare in their hand until a bird lights upon it. At certain times of the year great masses of edible caterpillars appear,



The organizer of the feast is distributing platters of cooked pork and bundles of sago to those whom he has invited to be his "dogs"—feasting partners—who later will give him other food in return for that which he now gives to them

An Arapesh Feast



Doctor Mead's
mountain house

*Below: In an Arapesh
yam garden*



Right: Beach Arapesh
carrying the casso-
wary-feathered spear
which gives notice
that pigs are due

Native

Feast

Below: Learning to
carry her share



In the center of the village, food which has been gathered together after many laborious months of preparation is piled into a "mountain." Around the edges are the sprouting coconuts which the visitors will take home and plant in memory of the occasion. The central pile of yams is decorated at the top with clusters of shining green betel nut and sections of smoked meat

and sometimes a mud hen's nest is found in the bush. There is a kind of grub which flourishes in rotting sago trees. Every bit of available protein is used, even snakes, although there is always the more than suspicion that a snake is really a supernatural. Still, the average adult is fortunate if he gets half a dozen ounces of protein a week. For the rest he must subsist upon vegetables, which makes traveling particularly difficult, for seven pounds of yams is a good days' fare for a grown man.

THE GENEROSITY OF A HUNGRY PEOPLE

Upon this scanty and inadequate food supply, what kind of a social system has developed? There are those who would argue from a pervading pessimism about human nature, that scarcity and hunger always tend to make men stingy and grasping, each holding tight to his own little portion of food and drink. Now, there is no doubt that, even by native New Guinea standards, the Arapesh are hungry. The figures of the grown people reveal the stigmata of rickets; most people's bones protrude sharply from too tightly stretched skins. They are poor and they are cold and they are hungry. Often there is no food in the house, the fire has died, and the people wake shivering long before dawn, to sit about a camp fire outside and sing softly until the sun rises. Pressing a visitor to stay means that the pot will be empty tomorrow, but no visitor is ever hurried on his way.

Once I asked an Arapesh man to describe a bad man, and he did it in these words:

A bad man is he who when he sees visitors come says: "Now, who is going to feed these people?" He and his wife sit down. Smoke issues from their house. He eats until his skin is stretched tight. He wipes the grease from his lips with the back of his hand. He goes and sits down with the visitors and makes empty talk. If he has killed meat, he hides it. If his wife is good and says, "Let's give a little of this meat to

a friend," he says "No." If the wife is really good, she will run away from such a man.

In their system of food distribution, the Arapesh divide all the people of the community into two classes, *bonah* and *shalloh*, children and old people on the one hand, and all those past puberty who are still hale and strong, on the other. Although there are some foods which may be eaten by both groups, many foods are divided so that one kind of yam belongs to *bonah*, another to *shalloh*. This system ensures that neither the strong shall take too much from the weak, nor the old too much from the young. After a feast, the givers of the feast spread food for their womenfolk who have labored faithfully bringing firewood and cooking leaves, and preparing food. This little family feast they garnish with wallaby, a food forbidden to all adults, because "the women will be even more happy to have food which can be eaten only by their children."

[HOW FOOD IS "STORED UP" FOR THE FUTURE

Strict social rules govern hunting and the distribution of game. The most despised man in the community is the one who will eat game which he has killed himself, be it only a bird the size of a sparrow. When Nahomen, a lazy, half-witted man from the hamlet of Mogiligung, took his small son hunting and together they devoured a hornbill which he had killed, the community rang with the scandal for weeks. Instead of eating one's own kill, it must always be sent to another, a mother's brother, a father-in-law, or a hereditary feasting partner, called a *buanyin*. This rule when applied to big game animals—that is, the biggest game animals known in New Guinea, the bush pig and the tree kangaroo, or the great wingless bird, the cassowary—works out into a sort of primitive banking system. Kule is giving a feast in three months' time. For that feast he will need much meat. He goes out hunting to find some

A native banana garden.
The natives lop off the
branches to let light into
their gardens, but do not
cut down the trees



At the time this picture
was taken there was rain
in the air, and the hosts
were waiting anxiously
for the visitors to arrive
before the storm burst.
They didn't!



small game for a little feast to his cousins who have just carved him a drum, and he kills a cassowary, far too much meat for a small feast. He smokes it and sends it off to his *buanyin*, who later, when Kule is ready to give his big feast, will return the same amount of meat, a domestic pig if he has no luck at hunting. So Kule, who has no means of keeping his cassowary kill, has stored up a future meat supply for himself. Kule's *buanyin* will distribute the cassowary among all his brothers and cousins and brothers-in-law, with a little extra amount for those who have good hunting dogs and so can be counted upon to help him return it later. Each of these may keep the leg or the slice of breast which they receive, for their own families, or pass it on still farther.

HOW MANY ENDS ARE SERVED BY ONE "KILL"

In this way, one kill may serve a number of diverse individual ends, Kule stores up for his feast, and has a bit of meat, too, to give to his drum-carving cousins; his *buanyin* feasts all his relatives; one of them may use his share to end his wife's period of taboo after childbirth by giving a feast for the midwife; another, now that he has a piece of meat, will ask his brothers to come and help him finish his house. So these impoverished, meat-hungry people succeed in deriving the maximum amount of excitement and delight from each hunting success. It is delightful to kill a cassowary, drums will send out the glad news and people will shout from mountain top to mountain top—the native telephone system in a country where a peak which is an hour's hard walking away, may be within easy shouting distance. It is delightful to bring the cassowary home; everyone in the hamlet will come to admire and exclaim and the children will pluck out the long horsehair-like feathers which will later be made into a headdress, or perhaps even into the fearsome mask of the cir-

cumcisor in the initiation ceremonies, who dresses to impersonate a cassowary. It is a pleasure to give it away with elaborate speeches, and it is a pleasure to be the recipients and dance around the meat laid out on plates on the village green, shouting "Wa Wa Wa," thus vociferously emphasizing the fact that some day this magnificent gift will be adequately returned. Finally, it is a pleasure to feast all one's coöperative friends who have helped one to build a fence or roof a house, or carve a drum. The host who goes hungry beams unenviously upon the feasters, and a few women set off hurriedly to carry bits of the feasts into still farther villages where some child will go to sleep happily chewing a bit of the meat which Kule killed, five villages away, some days before.

Sometimes, especially when a pig is given away, the first recipient feels that he cannot afford to keep it. He has no pigs himself; the women of his family are poor pig feeders, the friend in a far-away village who promised him a little pig has had bad luck with his last litter and sent none—altogether he is discouraged and pessimistic about accepting the pig. So he sends the pig, still trussed to a pole from which it will never be loosened until it is to be killed, to someone to whom he is indebted.

FURTHER ADVENTURES OF A GIFT PIG

This man in turn may send it to another, so that the unfortunate pig is trotted up and down, along winding paths and crumbling cliff edges, on the aching shoulders of shouting men, now five miles in one direction, now three miles in the other, sometimes lying for half a day in one hamlet, screened from the sun by a raised palm leaf, carefully tended and even fanned, while all those through whose hands it passes hope passionately that it will not die before it reaches a final destination. Because even the stoutest



A view taken from one end of the tiny mountain village which occupied the largest piece of level land in the whole mountain region. Eighty-seven people had residence rights in this village and returned to it occasionally, especially at feast time. The dark gable of Doctor's Mead's house shows over the rooftops at the extreme left

An Arapesh Village

pig weakens after several days of being carried trussed to a pole, there are frequent casualties, most often attributed by the natives to the disgruntlement of the person who fed the pig's grandmother and is now dissatisfied with the disposition of the pig grandchild, or else to the fact that the original owner of the pig has failed to observe the taboos prescribed for the time when one's pig is on the road.

"INVESTING" PIGS

In order to be able to plan feasts, the Arapesh have another system besides this one of banking a kill with a relative or a *buanyin*. The man who ultimately plans to give a big feast starts with one pig, which he has had raised and fattened by some women relative. He cuts it into large sections, cooks it, and gives a feast to which he has invited several men of consequence, the kind of men who "are accustomed to having pigs under their housecladders." He accompanies his gifts of pig with plates of beautifully made croquettes of taro or sago, rolled in grated cocoanut—a very special dish in the preparation of which men alone are proficient. Each guest receives a large amount of cooked food and a portion amounting to about a quarter of a pig. A few months later the feast organizer, the "trunk of the feast" gives another similar feast, and later a third. Each of the recipients—they are called collectively "the dogs"—has now received three-fourths of a pig and a great many of the most prized made dishes. They are each obligated to provide a whole pig when their host is ready to give his feast, while those who received plates of croquettes and small bits of the extra quarter of each pig, are obligated to help their host with vegetable foods. So for an investment of three pigs, serially, he is ensured four pigs at once.

The gardening habits of the Arapesh are as unexpected and as characteristic

of their whole genial approach to life, as are their habits of dividing up meat. Although everyone has garden land which is specially his, inherited from his patrilineal ancestors, the Arapesh do not follow the more usual Oceanic custom by which each man makes a garden, fences it, directs his wife's work in it, and claims all the harvest when it is ripe. For the Arapesh, although they can have no real village life, because there is no room in the mountains to build enough houses to make a real village, are a social folk who detest working alone. But the country is also unadapted to communal gardening on a large scale. So the Arapesh combine the ends of sociability and food growing, by each man's planting some of his seed in the gardens of half a dozen of his relatives; some with his brother, some with his uncle, some with his brother-in-law. Then one wife plants part of her taro with her mother, and part with his sister, the other plants with his cousin's wife. His sago patch is side by side with that of his cousin, because their two fathers were friends and planted together. His cocoanut trees are scattered over the locality because no one thinks of planting palms on his own land. Instead one walks five miles, carrying a single sprouting cocoanut to plant, as an act of courtesy and friendship, upon an uncle's house site. So every household in the community is knitted together in a fine mesh of common gardening, of trees plants at other men's back doors, of other men's yams sprouting in the land over which one's own ancestral ghosts preside.

THE DIFFICULTY OF MAKING MANY GARDENS

Gardening in so many places means that the whole population is semi-migratory. The women pack the wooden plates, the pots, the babies, the taro sprouts and freshly plucked bundles of greens, into their net bags, and the whole family sets

Distant view of the
mountain country taken
from the edge of Aliatoa,
looking inland toward
the grass plains which
the natives identify with
the sea



Native women gossiping
under a house roof after
a hard day's work in
the garden

The cruder form of native
house which is without a
floor and is built in gar-
dens and sago patches



out to sleep tomorrow in a different garden shack, of which each household has far too many to keep any one in adequate repair. So many cheerful gardeners crowd into one little hut that only a few can sleep by the fire while others must "sleep nothing," away from its heat, and the most unfortunate lie beneath a leak in the thatch. Fences, difficult enough to construct at all on the steep slopes, get out of repair in a week's time, and the bush pigs break into a temporarily deserted garden and eat the taro. But meanwhile the owners are eating, not too heartily, but very happily, and in company, taro planted somewhere else. Just as one garden fails, or is struck by a landslide, another will come to harvest, and the women will come home at nightfall, their jaws shut tight beneath the staggering weight of a net bag of yams.

THE LOST CALENDAR

In the Pacific Islands yams are usually planted and harvested at stated seasons, and often in accordance with a calendar. The Arapesh know of a calendrical system in which the months are named for periods in the orderly maturing of yams, such as "the moon when the yam vines redden," but they plant their yams at any time of the year when someone is ready to clear a patch of ground and a few are ready and gathered together. They have completely lost sight of the whole idea of the calendar and have no idea that it is at all contradictory for one man's October to be another man's December. "What moon is it now?" you will ask. They will scratch their heads, and think back to the last yam garden they have noticed. "Let's see. In Ahalesemi'i they will be harvesting before this moon dies. So this moon can be called the moon of yam harvesting." So by a casual disregard of

calendars and seasons, the Arapesh has avoided the lean "time hungry" in which there are no yams at all, which afflicts most yam-growing people.

A "MOUNTAIN" OF YAMS

No one may accumulate so many yams that he stands out from his neighbors as rich and a miser. If a man is lucky and his yams multiply, he is permitted—for so they phrase it—to give the feast called an *abulluh*. He paints all of his yams in bright colors, a new design for each 96, and spreads them out in a set order upon a long rattan tape measure. This he can fold up and tuck into the outside wall of his house, to record how many yams he had. Then he piles all of his yams into a "mountain," and summons everyone to a feast. To it they come bringing anything which they can spare, a new plate, a pot, a shell ring, a net bag. Upon a section of the yam pile the gift is laid, and the yams are gathered up and carried home as seed for next year's garden. The maker of the *abulluh*, the successful gardener, can never eat yams grown from this seed, which provides an anxious housekeeping problem for hospitable Arapesh women who must keep their yams carefully sorted out as to origin, so that no one may be offered the wrong ones.

Despite the scarcity of food and inclemency of weather, the Arapesh have a social system under which each man hunts that another may eat meat, fishes for someone else's cook pot, and tends his yams faithfully only to distribute the surplus among his neighbors as seed. The Arapesh, poor in soil and poor in foodstuffs, have turned the tasks connected with food-getting and food-distributing into delightful exchange instead of greedy parsimoniousness.

The Art of Painting in Pre-Columbian Central America

The Third of a Series of Six Articles on
Central American
Native Art

by
George C.
Vaillant

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Fresco, Tizatlan, Tlaxcala, Mexico. After Caso, 1927

CENTRAL American painting does not show the same masterly control over subject and material that is so evident in the architecture and sculpture. Perhaps this inferiority may be due to the rarity of examples. Frescos and deerskin or paper manuscripts are extremely perishable, so that few specimens have survived the action of the weather or the destructive fanaticism of the Spanish priesthood. Much more probably, however, the ritualistic restrictions which controlled the architecture and sculpture have limited painting even more, for this art was confined to a didactic or explanatory supplement to the religious symbolism expressed by the stone carving, or else was used for simple narrative purposes in connection with the historical annals.

The term "painting" we are using in the common sense of the word, to mean a picture, not the mere laying on of colors. Hence we shall not consider the designs on pottery vessels nor touch on the coloring

of sculpture, which was a universal Central American practice. On the border line of this subject are the low reliefs of Chichen Itza and the Usumacintla River sites. These sculptured friezes were coated and corrected with plaster before they were painted, but they do not really fall within the scope of *painting and draughtsmanship*. Therefore we shall confine ourselves to the examples of frescos, manuscripts, and vases which depict actual scenes, in distinction to designs.

Few frescos have survived, since those natural agencies which have caused whole buildings to crumble, attack first the paintings on their walls. The surviving examples display colors such as red, blue, yellow, and green, obtained from ochreous earths and sometimes from vegetable dyes. Occasionally scarlet cochineal, obtained from insects, was employed. The earliest examples known to us are from San Juan Teotihuacan in the Highlands of Mexico, where the painter, despite



Caracol,
Chichen Itza,
Yucatan

This circular astronomical observatory is shown partly restored by the Carnegie Institution of Washington. The disintegration by natural forces that ruins massive buildings like this, offers scant chance of survival to perishable materials like frescos and manuscripts. The wonder of Central American painting is that any examples survived at all

This limestone low relief from Tabasco illustrates the transition between drawing and sculpture. The Central American never could suggest by his brush the delicate contours he achieved in modeling



The painter of the vase from Guatemala, a detail of which is shown below, lacked only an accurate knowledge of perspective to equal the masterly result of the sculptor whose work is shown above. After Gordon, 1928



his rude drawing, has caught in lively terms a ceremonial scene. Especially noteworthy is a conventionalized design combining various fruits and plants.

Most of the frescos presumably date from the time immediately preceding the Conquest, and come from Yucatan where the rugged stone architecture resisted the elements, and in consequence preserved the fragile paintings within the rooms of the buildings. A number of the subjects seem to be secular. At the Temple of the Warriors, in Chichen Itza, two animated scenes were reconstructed by Anne Axtell Morris from the fallen blocks of the temple vault. In one a seaside village is shown, and in the other the defeat of a foray by marauding strangers. There is no real grasp of foreshortening, but the arrangement of the figures suggests a dawning knowledge of perspective. In the Temple of the Tigers at the same site there is a fresco depicting another attack, and in this case some rather successful attempts at foreshortening have been achieved. At other sites like Chacmultun scenes have been attempted but the draughtsmanship is crude.

RELIGIOUS FRESCOS

There are a number of purely religious frescos, without the secular element introduced by the presence of human beings. The most celebrated are found at Santa Rita in northern British Honduras, and at Tuloom on the east coast of Yucatan. In this group the element of design is dominant, and the divinities are arranged according to the dictates of ceremonial pattern. Curiously enough, although found in Maya territory, these frescos have strong affinities in subject and style to the paintings at Mitla in distant Oaxaca.

The Mitla frescos are entirely ceremonial, being composed of divinities and their attributes, and they are closely related to the codices or ritualistic books of

that area. Other Oaxacan examples are extremely rare, and in Central Mexico, save for the frescos at Teotihuacan already mentioned, the painted altars at Tizatlan, near Tlaxcala, alone are worth consideration. These designs are composed in brilliant colors, but the content is purely ritualistic and ceremonial. Like the Mitla frescos, the draughtsmanship is closely related to that of the manuscripts.

ILLUMINATED MANUSCRIPTS

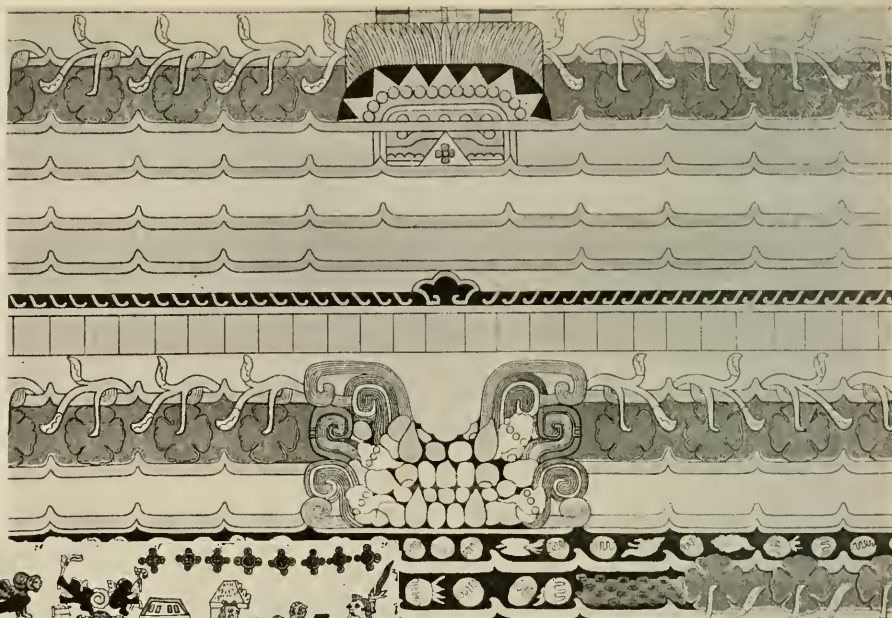
By one of those constant paradoxes in Central America, codices abound where frescos are few, and vice-versa. Thus on the Mexican Highlands there are many illuminated manuscripts, but, as we have seen, few frescos have survived. On the other hand, in the Maya country, the source of most of our knowledge of fresco painting, only three books have been preserved. For a knowledge of draughtsmanship, the manuscripts are a most valuable source of information. They include ritualistic and divinatory manuals, historical annals, tribute rolls, maps, and the like. Thus in the rendition of the subjects chosen, artistic considerations were always secondary to the needs of exposition.

Middle American writing was at a relatively primitive stage. It was ideographic and phonetic, the principle being that of our modern rebus. There was, however, no means of conjugating verbs or declining nouns. Consequently action had to be expressed by pictures. It is quite probable that long recitations learned by rote and passed on from generation to generation supplemented the picture writings which served as a mnemonic aid. A great many of these documents gave calendric and astronomical calculations, and the inscriptions are largely composed of the names and numbers of the various dates, the pictures of the gods presiding over the various days, and the ceremonies associated with them. [*Continued on page 398*]



Painted Relief
from
Chichen Itza

This carved wall from the lower chamber, Jaguar Temple, was covered with plaster and then painted. A procession of priests and warriors converges on an altar in honor of their god Quetzalcoatl, the Feathered Serpent. The warriors carry spears and spear-throwers, and the two priests have feathered robes in their hands



Ritualistic uses of painting. The upper picture, an altar at Teotihuacan (Gamio, 1922), shows religious formulæ reduced to pure design. The middle picture from the Codex Florentino describes a ceremony in which people dressed as birds or gods participate. At the bottom is a scene from the Vienna Codex after Humboldt, 1814. The content is partly ceremonial and partly historic



Descriptive uses of painting include this woodland scene from the Temple of the Warriors at Chichen Itza. The panther in the tree suggests that the artist cared more about defining his species than drawing them naturally. After Maudslay, 1889-1902]



Detail from a battle scene, Temple of the Warriors, Chichen Itza, shows considerable animation in the house to house fighting and the captives being led off for sacrifice by the black-painted priests. After Morris, Charlot and Morris, 1931





Tikal

This dramatic model constructed by S. J. Guernsey under the direction of Dr. H. J. Spinden for the Buffalo Museum shows a typical early Maya ceremonial center. The jungle has wreaked havoc with the site so that now little except the architecture remains of the achievements of its builders. Thus the incomplete patchwork comprising present knowledge of Central America utilizes scraps from many sources

Perishable remains like this plaster temple at Uaxactun, Peten District, Guatemala, are sometimes miraculously preserved. This model cross section shows how a later building sheathed the earlier structure and protected it



This fresco from Teotihuacan, perhaps the earliest in this series, was saved in the same way. Men and women offer gifts to the statues of two gods at either side of the picture. On the altars before them burn sacred fires. After Gamio, 1922



The three Maya books fall into this last category. As the Maya had developed an extremely conventionalized way of depicting word symbols, the pages, from an artistic point of view, do not compare with the Highland documents. Among the latter the manuscripts assignable to the Mixtec civilization are especially handsome. The day signs and the representations of the divinities are carefully, one might say arduously, drawn. Proportions are based upon the ritualistic importance of the details shown rather than their anatomical symmetry. Colors are used not only to reproduce natural tones but also to define the object ceremonially, since colors had a strong ritualistic significance in Central American religion. Permeating all the symbols, and their distribution on the page, is design, which follows closely in the train of the order implicit in ritual.

AZTEC PAINTING

In comparison to the Mixtec documents, the painting in Aztec manuscripts seems barbaric, but because it is less confined by ceremonial restrictions it has a freshness rather engaging to our eyes. Furthermore, the Aztec system of writing was incorporated into the Spanish colonial administration, both as a method for keeping legal records pertaining to Indian affairs and as a means for disseminating Christianity among the natives. It is, therefore, possible to see in a number of drawings the transition from a purely Indian to quasi-European style of draughtsmanship.

In the purely ceremonial documents, like the *tonalamatl* or sacred almanac, there was a close connection with the extremely stylized documents of the south, but there is more immediate interest to the casual reader in the annals. These follow two forms. One is in the nature of a map, where the events are set forth much as are localities. A knowledge

of the symbols defining personages and tribes does not explain the action entirely, so that manuscripts of this type must have been supplements to oral tradition. The other class is more self-contained. The symbols for the years were set down successively, and lines connect the various events pictured with the year glyphs. Some of these records, like the *annals of 1576*, were kept well into Colonial times, but the text gradually shifted from picture-writing to Nahuatl words transliterated into Spanish characters.

Another category of documents is composed of the tribute rolls, land grants, and similar administrative records. The Aztecs kept careful account of the toll to be exacted from the towns they conquered. Pictures of the objects with symbols for the quantity are set down together with the hieroglyphs designating the tributary pueblos. Other records show the land held by individuals and the rent payable, and, as these records were retained in colonial times, there is often a gloss in European characters, describing in Spanish or Nahuatl the significance of the document. A few colonial manuscripts exist wherein the symbols were rearranged into a sort of phonetic writing, suitable to record prayers. The Spanish priests broke down the ideographs into a system of actual writing, but the greater serviceability of Spanish characters caused this attempt soon to be abandoned.

CODEx FLORENTINO

The most diverting document from Central America is the Codex Florentino, a collection of pictures illustrating Father Bernardino Sahagun's exhaustive work, *A General History of the Things of New Spain*, written about 1565. These drawings depict every detail of Aztec social life and religion, not to speak of delightful excursions into natural history. The draughtsmanship suggests the phrase



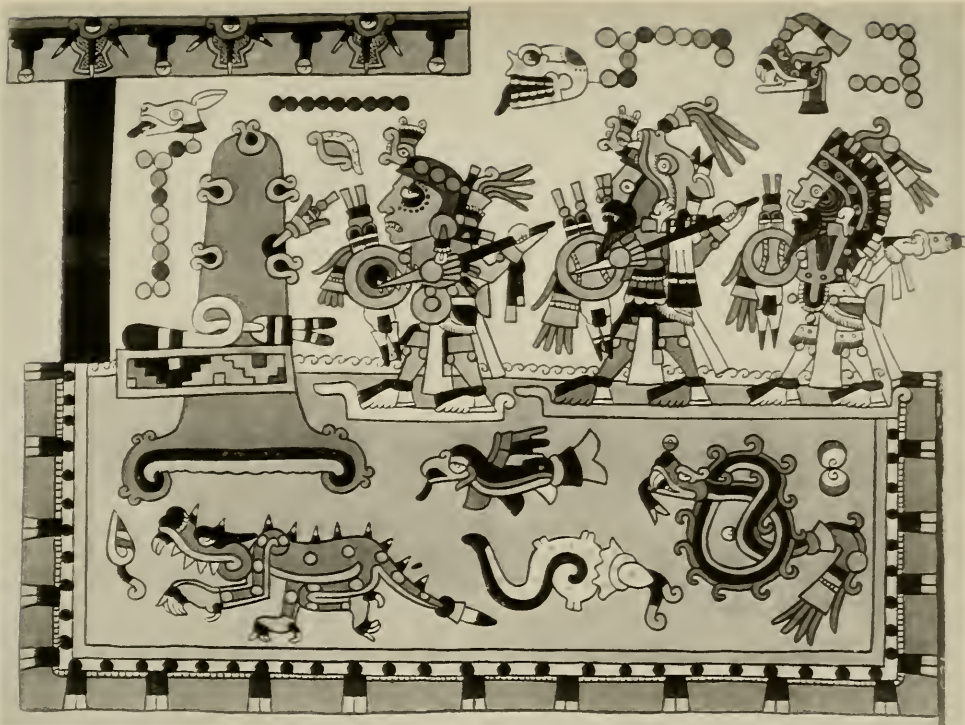
This mortuary bowl from Uaxactun shows great ease and freedom in drawing. The hole in the center of the vessel was made to kill the pot, so that it could pass with its owner to the next world.

After Smith, 1932

The detail shown below from another Maya vase commemorates the meeting between a Maya chief (at the left) and a noble stranger. The features are accentuated to express racial differences. The glyphs doubtless give explanatory details. After

Dieseldorff, 1904





This painting from a Mixtec history, the Codex Nuttall, involves a group of warriors in canoes, who are attacking a town on an island in a lake. Note the ingeniously stylized wild life which inhabits the water. After Joyce, 1927



No such schematic drawings as shown above mar this Maya vase from Copan, which represents a quetzal or trogon, the sacred bird of the Maya. After Gordon, 1928

"old wine in new bottles," since despite the influence of European methods of drawing, the content and psychology are Aztec.

The preceding pages have outlined the two principal sources for Central American painting, the frescos and the manuscripts. While the frescos show a certain fresh ability in presentation, the manuscripts on the whole exhibit the lifelessness that one would expect from the standardized repetition of signs and symbols already defined by ritual. The draughtsmanship does not equal the sculpture and the architecture. Yet there is the inevitable exception to every generalization, and this is to be found in a small group of Maya vases, where a lively and subtle style of drawing is to be found.

Human figures, naturalistically presented, are extremely rare in Central American pottery decoration, and are confined almost exclusively to the Maya region. The style commences at Copan in a vigorous shorthand and finally blossoms into its fullest flower in the Chama region of Guatemala, although there seems to have been a sub-center in the Peten district of the same country.

The scenes are apparently purely descriptive. A notable receiving an embassy from another tribe is depicted on one vase. On another a high personage is borne on a litter, and a third vessel is decorated by a scene wherein a chief

seated on a throne holds a levee. The racial types are exaggerated, but the positions of the body are as graceful in carriage as they are harmonious in design. The strong, sure outlines recall the best of the low reliefs from the Usumacinta River region, and it is apparent that the same school of draughtsmanship which inspired the vase painting controlled also the outlines of the reliefs. When we remember that sculpture was always painted in Central America, it will be seen that here painting and sculpture blend. In the Maya vase painting we have at last found an approximation to the beauties of the stone carving.

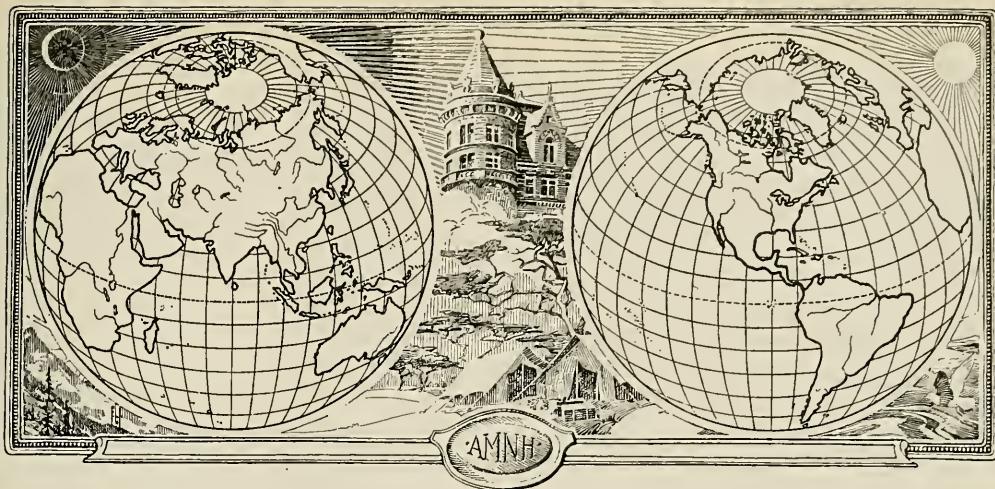
The art of painting in Central America exists for us by implication, much as does the delineative art of the ancient Greeks for which vase painting and literary description are the principal sources since the paintings themselves have disappeared.

The frescos are not really representative, because either, as in the case of the Teotihuacan examples, they came from a primitive civilization, or, as in the Yucatan, they were the product of a decadent one. In the codices, the draughtsman's skill, because of delineative and ritualistic conventions, had no opportunity to express itself save in design. Only in Mayan vase painting do we find that the painters

give indications of a skill equal to that of the architects and the sculptors.



Maya vase,
from Nebaj,
Guatemala.
After Gordon
1928



Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by
A. Katherine Berger

Second Expedition to Northern Patagonia

Dr. George Gaylord Simpson has completed successfully the Second Scarritt Expedition to Northern Patagonia. He and his assistant, Mr. Coleman S. Williams, left the American Museum on September 9, 1933, and proceeded down the west coast of South America, flew across the Andes from Chile to Buenos Aires, and from there traveled to the fossil fields of Chubut Province by motor car. The exploration this time was, as on the First Scarritt Expedition in 1930-1931, in beds of pre-Santa Cruz age, early Tertiary.

The most important discovery this past season was that of a small deposit, possibly the filling of a volcanic blow out, only a few hundred yards in diameter but extremely rich in fossil remains. Many complete skeletons and numerous more fragmentary specimens were obtained from this deposit and most of these will probably prove new to science.

The party returned to Buenos Aires late in March, and it is expected that the collection, in charge of Mr. Williams, will reach the Museum soon. Doctor Simpson has gone to Moscow where he will attempt to get permission to visit the dinosaur egg locality in Outer Mongolia this summer.

Jupiter in Motion Pictures

The Amateur Astronomers' Association completed its seventh year on the evening of May 16th, at which time there were shown for the first time in New York City direct motion pictures of Jupiter, the moon, and other celestial objects, made at the McMath-Hulbert Observatory of the University of Michigan. At the same meeting officers were elected for the coming year as follows:

President, Dr. Clyde Fisher.
First Vice-President, Dr. R. E. Lee.
Second Vice-President, Dr. O. H. Caldwell.
Third Vice-President, Dr. C. S. Brainin.
Fourth Vice-President, Mr. William Henry.
Treasurer, Mr. Charles J. Liebman.
Secretary, Miss Marian Lockwood.

The following were elected members of the Council:

Mr. Charles A. Federer, Jr.
Mrs. Virginia Geiger.
Mr. Stansbury Hagar.
Mr. Leo Mattersdorf.
Mr. Meyer Meadow.
Mr. A. Cressy Morrison.

A Planetarium for New York City

May 28 marked a long anticipated event in the history of the American Museum—the ceremony of breaking ground for the Hayden Planetarium Building on the Museum grounds.



Notables at the ground-breaking ceremonies of the Hayden Planetarium Building. Left to right, Clyde Fisher, curator of the new planetarium, F. Trubee Davison, president of the American Museum, Bernard S. Deutsch, president of the New York City Board of Aldermen, Charles Hayden, after whom the planetarium is to be named, H. E. Whittaker of the Reconstruction Finance Corporation, and Henry Fairfield Osborn, honorary president of the American Museum

The story of how the building was made possible by a loan from the Reconstruction Finance Corporation, and how the marvelous instruments, both the projection planetarium and the Copernican planetarium, were the generous gifts of Mr. Charles Hayden of New York City, was told in the May-June issue of *NATURAL HISTORY*.

Mr. Hayden, in whose honor the planetarium building is being named, turned the first spadeful of earth at the ceremonies. F. Trubee Davison, president of the American Museum, presided, and brief addresses were made by President Davison, Mr. Hayden, and Bernard S. Deutsch, president of the Board of Aldermen, who represented the City of New York. Mr. H. E. Whittaker represented the Reconstruction Finance Corporation. Under the leadership of Charles Ulivieri, the Bryant Concert Band furnished an excellent musical program.

The Zeiss Projection Planetarium was ordered from the Carl Zeiss Optical Works in Jena several weeks ago, and it is expected that the entire project will be in operation in about a year.

The contract for construction of the Hayden Planetarium was awarded to the White Construction Company.

Summer School of Natural History

The Alleghany School of Natural History opens its eighth season July 5, 1934, in Alleghany State Park, nine miles from Quaker Bridge, New York. This school is sponsored by the Buffalo Society of Natural Sciences in co-operation with the New York State Museum, and is affiliated with the University of Buffalo,

which gives college credit for work at the School. Courses offered include field zoölogy, field botany, field geology, natural history of birds, and nature study. Registration can be made with Harold T. Clement, the Buffalo Museum of Science, Buffalo, New York.

Blind Cave Fishes

Several specimens of blind fishes from a deep lake in a cave near Alacranes, Cuba, have been presented to the American Museum of Natural History by Van Campen Heilner as a result of his recent exploratory trip to Cuba. These fish, when alive, are of various shades of pink. They have lost their eyes through generations of breeding in underground recesses of continuous darkness. Two somewhat similar types of such blind fishes have previously been found in Cuban caves, but none have been brought from those near Alacranes. While much like these, the present specimens show some slight variations, which later study may show to be important in scientific significance.

Insect Portraits

The American Museum of Natural History has just received from the heirs of the late C. V. Riley, widely-known scientist, a practically complete set of the wooden blocks from which the original illustrations for his world-famous works on insects were printed.

Mr. Riley, who was appointed state entomologist of Missouri in 1868, was a leading pioneer in the work of controlling harmful insects. American agriculture owes much to his successful work.

His reports on the subject of insect pest control not only set a high scientific standard, but are charmingly written and illustrated by his own drawings, which have become a standard in much the way that the bird drawings of Audubon have done. Scarcely a book on insects has been written since that time which does not include pictures inspired by his work. The gift includes more than 1000 wood cuts, together with some early electrotypes.—F. E. L.

Insects vs. Insects

A division of foreign parasite introduction has been established in the Bureau of Entomology, U. S. Department of Agriculture, to direct the importation of parasites and other natural enemies of insect pests. C. P. Clausen, who has headed several insect exploration trips to the Far East, will be in charge of the new division. In making this announcement, Lee A. Strong, chief of the Bureau, said:

"One way to combat insect pests which have been introduced accidentally into the United States from abroad, is to introduce deliberately the parasites and predators that keep these insects from becoming major pests in the country of their origin. This calls for the discovery of the insect enemies, their safe transportation, and their successful colonization in a new land.

Because of the balance that nature maintains between insects and their enemies in their native habitat, it is often very difficult to run down the parasites and predators needed for investigation. Once found, they must be carefully tested and then, if the results of the tests warrant, means must be found for their safe shipment over a long distance. Only recently have modern transportation and refrigeration facilities removed many of the obstacles from this phase of the work. Nor can newly arrived insects be turned loose at once. They must first be given time to prove that they will carry on the work they did back home and not develop a tendency to attack other useful insects already established.

Several small beetles, flies, and wasps have proved their worth in cutting down the numbers of fruit insect pests in America. A little beetle from Australia, in 1888-89, rescued the citrus fruit industry in California from the cottony-cushion scale, also a native of Australia. This successful rescue from a dangerous pest cost the Government only \$1,500. It has saved American fruit growers millions of dollars. More recently, a tiny parasite discovered by Mr. Clausen in Asia has relieved citrus fruit growers from fear of the citrus black fly which had migrated from tropical Asia to Cuba, the West Indies, and

Central America. Released in orchards there, this parasite soon reduced its ancient host to safe numbers. Thus the danger of the black fly's entry into this country was greatly reduced, and a weapon made ready for American growers in case of need.

A large number of parasites and predators brought from Europe and Asia have helped to maintain the balance of nature over much of the area infested by gipsy and brown-tail moths.

Insect explorers at the three stations maintained by the Bureau of Entomology abroad, will continue their search for new enemies of insect pests. In Japan the search will be directed primarily toward the discovery of parasites and predators of the Japanese beetle, the Asiatic beetle, and the Oriental fruit moth; that in France to enemies of the corn borer, alfalfa weevil, and Hessian fly; and that in Austria to insects that prey on the European pine shoot borer, birch bark scale, larch case bearer, and other forest insect pests. These explorers, however, will not confine their search rigidly to these particular species. Each will be concerned with any insect enemy of an American crop pest that he may find."

The Hall of Insect Life in the American Museum shows some of these and other important insect friends of Man.

Water-walking Lizards

An interesting collection of reptiles from Teuhantipeec in southern Mexico has recently been given to the American Museum of Natural History by T. MacDougall of New York. Particularly notable are the only specimens of the spring tail lizard (*Ctenosaura quinquecarinata*) which are known to be now living in captivity. This lizard has been known only since 1842, and only twenty-one specimens of it are on record. The two pairs presented to the Museum have begun to breed. The lizards are about fifteen inches long and are related to the iguanas.

There is also in the MacDougall collection one specimen of the basilisk lizard, which is noted for its ability to walk upon the water, as well as several specimens of the uncommon *Cnemidophorus deppii*, which is a small, and less brilliant Mexican relative of the common pine swift lizard of the New Jersey pine barrens.

600,000 Frogs in Embryo

About seventy quarts of frogs' eggs, which mean a potential pond population of from five- to six hundred thousand frogs, have recently been acquired by the American Museum of Natural History for use in its school service department.

These eggs are kept in cold storage to retard their growth until they are needed. They are greatly in demand for use in nature study in New York and neighboring schools.

Experimenting with Forests

Eight experimental forests have been designated in widely separated regions of the United States by Chief Forester F. A. Silcox, it was announced by the Forest Service, U. S. D. A.

Each experimental forest is composed principally of a type of forest cover representative of large sections of the national forests and the private forests of the region. Areas of the experimental tracts vary from about 1,000 to 17,000 acres. All are located on national forest lands.

The eight forests were chosen after thorough study by the Forest Service of their value as outdoor laboratories for working out problems of timber growing, watershed protection, erosion control, etc. They will be maintained and operated under the direction of the Forest Service's regional forest and range experiment stations, for practical scientific investigations of regional and general problems of forestry and land use.

Studies will include watershed problems in California and Utah, and forest management and timber growing in the Northwest, the Ozarks, and the Southern Pine Belt, and other investigations.

A Million Dollars for Birds

One million dollars of Emergency Conservation Work funds were allocated for migratory-bird restoration purposes by President Roosevelt on April 19. Executive Order No. 6684 authorizes the purchase and rental of lands as refuges for migratory birds and other forms of wild life that constitute a diminishing natural resource. Acquisition and proper development of the

refuge lands will provide protection not only for the depleted wild-life resources but for the lands themselves. The work incident to acquisition and improvement will also provide employment on useful public work.

Mortuary Urn from South America

Through the generous interest of Mr. Alonzo Wittick and Mr. C. K. MacFadden, the American Museum has just received a rare mortuary urn from the Ocaño district near Los Angeles, east of the Magdalena River in Colombia. It was found in a stone crypt which, with several others, was covered by a low mound. Within the urn were placed the bones of an individual, a condition indicative of secondary burial, since, apart from the difficulty of placing the bones in so small a container, the head was also missing.

This urn, of unslipped clay, is equipped with three handles and two ornamental bosses in the form of animal, perhaps frog, heads. Below each head hang three tassels terminating in the same number of pendants. The lid of the urn is convex



A mortuary urn of clay from the Ocaño district, Colombia, which has been presented to the American Museum

and acts as a seat for a female figure, whose face is painted white. The style of the figure suggests potential affinities with those important but ill-defined cultures of northern South America.

In the opinion of Prof. Marshall H. Saville, no such specimens are in the possession of American or European museums. Three similar vessels from the same general region and in a slightly more advanced art style are figured in the *Journal de la Société des Américanistes*, n.s. Vol. XXIV, pp. 210-211. The American Museum is greatly indebted to Messrs. Wittick and MacFadden for this superb addition of great intrinsic and scientific value to its South American collections.—G. C. V.

Accessions

Among the recent items of interest and importance received in the Library of the American Museum by gift or exchange are the following:

Catalogue of Books, Manuscripts, Maps and Drawings in the British Museum (Natural History). Volume VII Supplement J-O. London, 1933.

A Catalogue of the Works of Linnæus . . . Preserved in the Libraries of the British Museum and the British Museum (Natural History). Second Edition. London, 1933.

Dieseldorf, E. P.—*Kunst und Religion der Mayavölker*. III. Die Datierung der Tempel. Hamburg, 1933.

Marcus, Ernst—*Tiergeographie*. Potsdam, n. d.

Peterson, Roger Tory.—*A Field Guide to the Birds*. New York, 1934.

Reichard, Gladys A.—*Melanesian Design. A Study of Style in Wood and Tortoiseshell Carving*. Volumes I, II. New York, 1933.

Villacorta, J. Antonio y Villacorta, Carlos A.—*Códices Mayas*. Reproducidos y Desarrollados. Guatemala. C. A. 1930.

Recent American Museum Publications

During March and April the following *Novitates* and *Bulletin* were published by the American Museum:

NOVITATES

- No. 695. Some Instances of Incurtations Selective upon Crystal Forms. Stilbite Incrusting Apophyllite. By Clifford Frondel.
- No. 696. The North American Lonchopteridae (Diptera). By C. H. Curran.
- No. 697. Records of Western Bees. By T. D. A. Cockerell.
- No. 698. A New Fossil Zalambdodont Insectivore. By Erich Maren Schlaikjer.
- No. 699. The Distribution of Rotifera on Mount Desert Island. Part IV. New Notommatidae of the Genus *Cephalodella*. By Frank J. Myers.
- No. 700. The Distribution of Rotifera on Mount Desert Island. Part V. A New Species of Synchaetidae and New Species of Asplanchnidae, Trichocercidae, and Brachionidae. By Frank J. Myers.
- No. 701. The Deslongchamps Publications on Fossil Crocodiles. By Charles C. Mook and Leonora R. Borker.
- No. 702. A New Species of *Teleorhinus* from the Benton Shales. By Charles C. Mook.
- No. 703. Studies of Peruvian Birds. XII. Notes on *Hylaphylax*, *Myrmothera*, and *Grallaria*. By John T. Zimmer.
- No. 704. Correlation of Ossiferous Sections in the Upper Cenozoic of India. By Guy E. Pilgrim.
- No. 705. Studies of African Land and Fresh-Water Mollusks. West African *Achatinae* Related to *Achatina balteata* Reeve. By J. Bequaert and W. J. Clench.
- No. 706. Reactions of *Drosophila* to 2537 A Radiation. By Frank E. Lutz and E. N. Grisewood.
- No. 707. Notes on American Crab Spiders (Thomisidae). By W. J. Gertsch.
- No. 708. Fourteen Hitherto Unrecognized African Rodents. By Robert T. Hatt.
- No. 709. Birds Collected During the Whitney South Sea Expedition. XXVIII. Notes on Some Birds from New Britain, Bismarck Archipelago. By Ernst Mayr.
- No. 710. Notes and Descriptions of African Diptera. By C. H. Curran.
- No. 711. Fossil Birds from Mongolia and China. By Alexander Wetmore.
- No. 712. Some American Spiders of the Family Hahnidae. By W. J. Gertsch.
- No. 713. Bats from the Pacific Islands, Including a New Fruit Bat from Guam. By G. H. H. Tate.
- No. 714. Birds Collected During the Whitney South Sea Expedition. XXIX. Notes on the Genus *Petroica*. By Ernst Mayr.
- No. 715. A Review of the Races of *Buthraupis eximia* (Boissonneau). By Robert T. Moore.

BULLETIN

Vol. LXVII: Fossil Invertebrata from Northeastern Brasil. By Carlotta Joaquina Maurey.

A Resignation and an Appointment

At a meeting of the Board of Trustees of the American Museum, held May 7, Mr. E. Ronald Harriman was unanimously elected a member of the Board in the class of 1936, and was also appointed treasurer of the Museum to succeed Mr. James H. Perkins who has resigned.

The Trustees in accepting Mr. Perkins resignation, adopted the following resolution in appreciation of his valuable service to the Museum:

Resolved, That the Trustees accept with sincere regret the resignation from the Board of Mr. James H. Perkins and at the same time desire to express to him their deep appreciation of the able, conscientious, faithful and efficient service he has rendered to the Museum since his election as a Trustee on January 3, 1927, on which date he was also elected Treasurer—an office he has held throughout his trusteeship. As Chairman of the Finance Committee and as a member of the Executive Committee, he has given freely of his wisdom and time to the financial administration of the Museum. He also served during 1927 and 1928 on the Trustees Committee on Fishes, and acted as Treasurer of the Sixtieth Anniversary Endowment Committee from its inception in 1931 to the present time.

In accepting Mr. Perkins' resignation, the Trustees wish to assure him that his presence will be genuinely missed and that his record will stand as an inspiration to those who have had the privilege of being intimately associated with him.

DISTINGUISHED GUESTS

D. M. S. WATSON, F.R.S., professor of zoölogy at the University College, London, and one of the leading paleontologists of Great Britain, with F. R. PARRINGTON, Strickland curator of the University Museum at Cambridge University, England, were guests of honor on the afternoon of Wednesday, April 11, at the American Museum of Natural History. On this occasion a reception was given in their honor by the Osborn Research Club, which is composed of members of the scientific staff of the Museum.

The Museum's department of comparative anatomy each year sponsors a lecture known as the JAMES ARTHUR LECTURE ON THE EVOLUTION OF THE HUMAN BRAIN, which is perpetuated by an endowment given by the late James Arthur of New Rochelle, New York. Professor Watson came from London to deliver the third lecture of this series on April 24, when he spoke on "Fossil Brains from Fish to Man."

Another prominent scientist recently visiting the Museum was SIR FREDERICK MOORE, late of the Museum of Arts and Sciences of Dublin, who with LADY MOORE came to New York, where they both acted as judges in the recent exhibition of the Federated Garden Clubs. Sir Frederick expressed especial appreciation of the habitat groups on exhibition at the Museum, commenting upon the accuracy and realism of botanical specimens in the various settings.

Scientists Convene

The American Museum recently was host to a number of distinguished scientists who gathered there from May 8 to 12 to attend the annual meetings of the American Association of Physical Anthropologists, the American Society of Mammalogists, and the American Society of Ichthyologists and Herpetologists. At the meeting of the Physical Anthropologists, Prof. Raymond Pearl was elected president, Dr. H. L. Shapiro, secretary-treasurer, and Prof. T. Wingate Todd, member of the executive committee.

The beautiful new laboratories in the department of experimental biology on the sixth floor of the African Wing were thrown open for the first time to visitors and for demonstration purposes during these meetings. Recent discoveries of fossil reptiles were also shown in the laboratory of vertebrate paleontology.

Members' Day

The Sixth Annual Members' Visiting Day was observed at the American Museum on Friday, May 18, particularly commemorating the Sixty-fifth Anniversary of the founding of the Museum. During the sixty-five years of its remarkable growth, the Museum has striven to maintain the highest standards of exploration, research, exhibition, and instruction. Its present estimable position in the museum world is due in a large measure to the pioneer work which the institution has carried on.

The program for Members' Visiting Day this year was arranged to illustrate for the members the contrast between the old and the new in museum practice, with particular emphasis on the latest developments in research and exhibition. There was a conducted tour "behind the scenes" and to some of the exhibits most recently opened, including the Lindbergh exploration

plane and the Drummond Collection of Ancient Jade, Amber, and Ivory. The studios of the department of preparation were open for inspection, and members and

their guests visited the Akeley African Hall, in which large mammal habitat groups were observed in all stages of installation. In the new laboratories of the department of biological research, which occupy the entire sixth and seventh floors of the African Wing, some of the Museum's interesting research problems were demonstrated.

After the tour of the Museum, members and their guests assembled for tea in Education Hall, where an exhibit of work of the children in the art classes of the elementary schools of New York City was on view. President Davison extended the greetings of the institution and briefly reviewed the history of the Museum.

Music was furnished by the New York Salon Orchestra, with George Rubinstein conducting.

A Gift in Bronze

Through the generosity of Mr. George D. Pratt, the first two of the series of African bronzes that are to ornament the new Akeley African Hall have been presented to the American Museum. They are life-size figures by Malvina Hoffman, chosen from her masterly series in sculpture representing ethnic types all over the world.

Set against the deep-green marble columns of African Hall, the sculptured figures are to serve as a decorative complement to the architectural beauty of the hall and add a human element to the life of Africa as portrayed in the animal habitat groups.

Miss Hoffman's distinguished art is at its best in these two bronzes selected by Mr. Pratt as his gift. One represents a tom-tom drummer, a lean, taut figure, an inch over six feet in height,



In the new experimental biology laboratories at the American Museum which were opened for the first time to visitors in the early part of May

with a tall, narrow drum braced between his lithe legs, his head thrown back in a gesture of rhythmic ecstasy, one hand grasping the drumstick, the other poised above the drum head, ready to strike. The other figure is that of a young Daboa dancing girl, a slender, long-

limbed creature, five feet, nine inches, tall, wrists and ankles adorned with bracelets. One arm is extended, the other hangs at her side.

The bronzes are now being cast, and it is expected that they will arrive at the Museum during the summer.

Recently Elected Members of the American Museum

New Members and New Honors

The following resolution was adopted at a meeting of the Board of Trustees of the American Museum, held May 7, 1934:

Resolved, That the Trustees are deeply appreciative of the generous support of the Museum by its many friends, and in recognition of gifts of specimens or of cash contributions take pleasure in making the following elections to membership:

| <i>Associate Founders</i> | <i>Patrons</i> |
|------------------------------|------------------------------|
| Mrs. Childs Frick | Mr. Eman L. Beck |
| Mr. Clarence L. Hay | Mr. Dean Sage, Jr. |
| Mr. Horace S. Scarritt | |
| <i>Associate Benefactors</i> | <i>Fellows</i> |
| *Ludwig Dreyfuss | Hon. Robert Woods Bliss |
| *John De Witt Sterry | Mr. John D. Rockefeller, 3rd |
| <i>Life Members</i> | |
| Mr. Templeton Crocker | |
| Mrs. van der Woude | |

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Life Member

Mrs. EUGENE H. POOL.

Sustaining Members

Messrs. EUGENE O'NEILL, ARTHUR E. PEW, JR., G. HOWLAND SHAW.

Annual Members

Messrs. HENRY SLOANE COFFIN, JOHN F. FOWLER, ARNOLD FRYE, ELIAS KEMPNER, H. R. KINSLEY, B. MAYER, LUCIUS W. MAYER, CHARLES G. MEYER, LANCASTER MORGAN, BLANCHARD MUNDY, THOMAS W. PHILLIPS, JR. Mlle. MONIQUE ROBERT.

Misses DOROTHY BILDERSEE, REGINA C. M. BURKE, ANNA E. CLEMENCY, MARIAN B. MAURICE, MARY MCCREERY, ELSIE ROCKEFELLER.

Doctors RAPHAEL KURZROK, JOHN BUTLER MCCOOK, K. WINFIELD NEY.

Professor HARRY L. PARR.

Messrs. HAROLD NORMAN ALTMAN, WILLIAM G. BOND, THOMAS D. CABOT, CHARLES COPELAND, M. D. CUNNINGHAM, EVERLY M. DAVIS, JR., LUIS GAMARRA DULANTO, FREDERICK GOLDSMITH, SIMON HIRSDANSKY, JOHN H. JONES, ARTHUR MACAULEY, ROBERT B. MARSHALL, JOHN F. MCCOWAN, HERBERT J. MCCREARY, D. D. L. MCGREW, BERTRAM A. MEYER, CLIFTON M. MILLER, WILLIAM D. MITCHELL, ROBERT T. MOORE, KEITH L. MORGAN, EMIL MOSBACHER, EDMUND W. MUDGE, JR., JOHN MUNROE, REA A. MURDOCK, W. H. NORRINGTON, INNIS O'ROURKE, F. W. PAINE, CHARLES J. PHILLIPS, EDWARD S. PINNEY, WILLIAM KELLY PRENTICE, JULIEN J. PROSKAUER, ELWOOD R. QUESADA, VICTOR F. RIDDER, FREDDY L. ROCKEFELLER, SAMUEL SLOAN, WALTER TRUMBULL.

Associate Members

Mesdames LORA H. CHALMERS, W. J. CHILDS, A. L. DARGATZ, JOHN WILLIAM DRAPER, JAMES FAIRLIE, JULIAN A. GREGORY, F. P. HART, FRANCES HIRSHENHORN, G. MARIA HOYT, H. A. LIGON, CAMILLA H. LIPPINCOTT, ELIZA W.

*Deceased.

LOOMIS, GRANT C. MADILL, GEORGE H. MAIRS, CHARLES CYRUS MARSHALL, EDWIN A. MCALPIN, A. B. MCCLELLAND, E. H. MCKONE, ALLAN McLANE, JR., J. B. MILLER, SR., WM. H. MITCHELL, AMELIA BERNDT MOORFIELD, A. REYNAUD MORRIS, EUGENE S. MORRIS, IDA M. NEEB, EWING NOYES, GRACE FOREMAN PAGE, J. CULBERT PALMER, JR., ARTHUR A. PARKS, CHARLES RUSSELL PECK, ALMA PETERSON, J. DUDLEY PHILLIPS, DANIEL A. POLING, WILLIAM EVELYN PORTER, C. K. POST, HARDEN DE VALSON PRATT, ALVA RAYNER, ARTHUR L. SAUNDERS, E. SCHUEMANN, C. N. TITTERINGTON, H. O. TOMPKINS, JOHN J. VIANO, R. B. WOODLTON.

Misses ELIZABETH DICKENS, GERTRUDE GOTTSCHALL, LAURIBEL HART, LILLIAN W. HARVEY, MABEL KERR, RUTH M. KESSLER, EVA KLAUSMEYER, CAROLYN B. MACFARLANE, MARY MAIER, GERALDINE R. MCALPIN, LOUISE A. McDOWELL, MARGERITE M. MCKEE, CONSTANCE MCKINLEY, HARRIETT MEEK, ELISABETH W. MIXTER, GERTRUDE MOODEY, HELEN A. MOWRY, ANNA A. O'NEILL, JESSIE ALLEN PAGE, LILLA E. PAYNE, NATALIE PETERS, LINA M. PHIPPS, MILDRED ELIZABETH PLANT, LEILA R. RAMSDALL.

Count GIACOMO QUINTANO.

Doctors JOHN S. BOUSLOG, FRANK CHAUVET, D. BRYSON DELAVAN, SIDNEY L. FORD, G. L. FOSTER, ALF GUNDERSEN, M. F. HICKERNELL, H. V. KING, ROY M. LEDFORD, MOSES N. LEVINE, STEPHEN LOCKETT, W. N. MILLER, CAROLINE MIMS, GEORGE W. NORRIS, A. P. OUSDAL, DOUGLASS PALMER, BENJAMIN H. PRIOROSKY, LAURENCE F. RAINSFORD, T. RAKIETEN, N. O. RAMSTAD, ROBERT N. ROSS, M. RUSSELL STEIN.

Professors CHAS. G. MAPHIS, JEANNETTE MARKS, WILLIAM PETERSON, EARLE B. PHELPS, O. E. PLATH.

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Reviews of New Books

Recent Publications For Those Interested in Nature

Lions Wild and Friendly. By Eric F. V. Wells. The Viking Press, N. Y., 1934.

MR. WELLS states on his title page that he is "Presenting the King of Beasts as a companion and an interesting subject for photography in his natural habitat. The anecdotes of one who has reared lions as a hobby." The book lives up to its title.

The author has given us a very unusual story, unusual in the incidents it describes, unusual in the point of view toward the lion, and unusual in the high standard set by the photogravures which so admirably illustrate the text. In the format selected, with large pages, easily read text and generous illustration, one might judge that the work was designed to appeal to children. There is nothing juvenile in the treatment, however, and the adult who picks up the book will probably not lay it down until he has read from cover to cover, a matter of 108 pages. Lest these observations might imply that children would not do the same, this reviewer should note the fact that he had no opportunity to read the book until each of his three children had taken turns at it.

The stories of lion behavior are simply and convincingly related, but the reader is forced to marvel at the apparent lack of tragic accidents where seemingly the stage is so well set for them. One can understand a partial confidence and trust between a man and a full grown lion, hand-reared or wild, but Mr. Wells displays a courage and willingness to trust his feline companions to a surprising degree. When a full grown lion leaps upon Wells and his pony, rolling them over, the author concludes that it is all in play, albeit somewhat rough, and treats the incident very coolly. He has proof of the logic of his reasoning in the many episodes of his experiences with lions, and he must have grasped much of the royal feline psychology.

Successful as Mr. Wells has been in his cultivation of lion society and thrilling as his dealings with the big cats have been, it is not anticipated that the average reader of his book will be obsessed with the idea that he can go and dolike-wise. After all, Mr. Wells need have been mistaken only once, during some of these associations, to have provided quite another ending to the story.—H. E. ANTHONY.

Bumblebees and Their Ways. By Otto Emil Plath. With an introduction by William Morton Wheeler. MacMillan, New York, 201 pp., 10 plates (of which 3 are in color), 20 text figures.

THIS admirable book represents the results of some thirteen years of study devoted to one of the most interesting groups of social insects. There are many different species of bumblebees—from the New World alone about one hundred forms are recognized; but of the colonial life and habits of the greater number of these little is known. Doctor Plath has succeeded in making intimate studies of nearly all of the seventeen species that occur in New England, including the industrious species as well as the guest species of the genus *Psithyrus* that profit by the labor of the industrious species. Lest the uninitiated reader have the impression that such studies are a light task, be it said that for the most part these insects nest in the ground. To become acquainted with them, their nests must first be located, then exhumed—not an easy accomplishment when, as frequently happens, in excess of one hundred insects each armed with a sting offer opposition—and finally transported, aggressive adults as well as passive brood, to prepared nest-boxes. This achieved, if all goes well, the observer is in a position to note the daily behavior of his colony during the weeks or months before the colony comes to an end, for, in the temperate zone at least, these colonies are not perennial. To indicate with what persistence and success the author has gathered data for study, it need only be mentioned that out of a total of 282 nests discovered, no less than 202 were transferred to nest-boxes for further observation. Add to this the familiarity on the part of the author with the literature of the bumblebees, evidenced by frequent references to the conclusions of other workers and by the comprehensive Bibliography at the end of the volume, and it is little wonder that Doctor Plath has produced a book so dependable and informing.

In spite of the fact that eminent entomologists have been attracted to the study of the bumblebees, their published reports are at conflict regarding not a few details of the behavior of these bees. Through his careful observations and thanks to the wealth of his material, Doctor Plath has been able to clear up some of these mooted points. At the same time, the behavior

pattern, as illustrated by Doctor Plath's observations, differs in interesting ways from species to species and makes generalization difficult. Perhaps there is no more interesting section of Doctor Plath's work than that which deals with the reactions of different species to the intruding queen of the inquiline bumblebee (*Psithyrus*). At times her acceptance is more or less passive; in other cases she is stung to death by the angry workers; but the most remarkable reception is witnessed in nests of the species *servidus*, the workers of which eject drops of liquid (presumably honey) over the velvety livery of the intruder until, drenched and bedraggled, she is anxious to make her escape from a nest where her presence is so little appreciated.

The book, which has ten plates—three of them in color—and twenty text figures, the greater number of them maps showing the geographic distribution of the several species considered, may be recommended to the lay reader for its non-technical presentation of a subject that is deserving of wider popular interest. By the student the book will be welcomed not only as a summary of Doctor Plath's published papers on the Bombidae but also for the hitherto unpublished observations that it offers.

—H. F. SCHWARZ.

Red Man Echoes, Comprising the Writings of Chief Buffalo Child Long Lance and Biographical Sketches by His Friends, edited by Roberta J. Forsberg. Published by Frank Wiggins Trade School, Los Angeles, 1933.

UNDER the title of *Red Man Echoes*, a beautiful memorial to Long Lance has been prepared by Roberta J. Forsberg, in the form of an elegantly bound and well printed quarto volume of 219 pages, fully illustrated. The frontispiece is a camera study of Long Lance by his friend, Bob Davis of the *New York Sun*, the same photograph that the latter uses in his gorgeous volume, *Man Makes His Own Mask*. The striking cover design, entitled "He Who Shoots the Stars," Miss Forsberg writes, is an adaptation of an Indian statue by Philip Sears, which stands overlooking

the Nashaway Valley in Massachusetts, a valley set aside for the Indians, and in which there is located an Indian Museum,—a most appropriate design for a book devoted to this energetic and highly sensitized American Indian.

A large section of the book is made up of writings of Long Lance, not included in his book, which he reluctantly permitted his publishers to call *Long Lance*, an un-Indian thing to do, he said. By the way, his own book, *Long Lance* was published in an American edition, in an English edition, and was translated and published in an Italian edition (Milan). These selections in the memorial volume, take from his writings in *The Cosmopolitan*, *McClure's*, *Good Housekeeping*, *The Mentor*, and other magazines, show well Long Lance's unusual literary ability, an ability that many of his white brothers would have been proud to possess.

In the Foreword to the American edition of this book, Irvin S. Cobb writes, "I know of no man better fitted than Chief Long Lance to write a true book about the true American Indian and I know of no book on the subject which better reveals the spirit of the Indian in the years that are gone and the spirit of times the like of which will never be seen again. I claim there is authentic history in these pages and verity and most of all a power to describe in English words the thoughts, the instincts, the events, which originally were framed in a native language."

Another part of the memorial volume is made up of interesting and revealing letters written by Long Lance to his close friend, Rev. Canon S. H. Middleton, Principal of the St. Paul's School, on the Blood Indian Re-

serve, Cardston, Alberta, one of those to whom he dedicated his book.

Long Lance's valedictory address at the Carlisle Indian School for the class of 1912 is given in full. Some of his earlier work from the columns of the *Calgary Herald* and the *Winnipeg Tribune* is



Chief Buffalo Child Long Lance, in aviation costume when he was a student at Roosevelt Field

given, and also the story of the "Silent Enemy," in which motion picture, depicting the Indian before the white man came, he and Yellow Robe played the leading parts.

The book is not a commercial venture, and no copies are for sale. However, they have been distributed among Long Lance's loyal friends, and in certain libraries such as that of the American Museum of Natural History, St. Paul's School on the Blood Indian Reserve, and in that of the Explorers' Club, Long Lance being the only American Indian who has ever been a member of the Explorers' Club.

Altogether it is an excellent piece of book-making, presenting an intimate picture of a fine Indian person,—a worthy memorial for which Long Lance's friends will be grateful.

In view of all this, it is doubtless in bad taste to express a wish that Miss Forsberg had secured and included tributes from a few more of Long Lance's great friends, namely, Frazier Hunt, Bob Davis, Irvin S. Cobb, Constance Lindsay Skinner, Peter B. Kyne, J. P. McEvoy, Will James, Bob Bartlett, and Will Beebe.

Athlete, soldier, student of Indian languages and sign-talking, writer, lecturer, *raconteur par excellence* (doubtless a heritage from his Indian ancestry), Long Lance was a man among men.

"To live in hearts we leave behind is not to die."—CLYDE FISHER.

The African Today. By Diedrich Westermann. 339 pp. Oxford University Press. London, 1934.

THERE is a steadily growing interest in negro Africa. As elsewhere, the contact of European and primitive is working rapid changes in the lives of the natives. Many are disposed to lament the transition, but similar changes have occurred wherever peoples came in contact—it is the order of human life. Anyway, in this new book we have a clear and for the most part readable statement of the present situation. To the museum visitor the chapters on economic bases of life, arts and crafts, and the supernatural world will be of special interest; to those interested in mental and social problems such topics as the negro's mind, the group and the individual, and the clash of races, will prove stimulating.

In the matter of crafts, the author says, "It will be regretted that African crafts are doomed to destruction. The development is, however, inevitable." (p. 103). Again, "It is especially regrettable that the Africans themselves have lost their belief in their own art, and that the educated classes are showing them a bad example in this respect." (p. 106).

Cattle raising is an important thing in the

lives of many tribes. With us this is a mere matter of economics, but many Africans love their cattle, live with them, decorate their horns, and maintain them in useless numbers. "In these circumstances separation from a favourite animal is a real sorrow, and the idea of slaughtering it for a mere material purpose strikes the owner as cruelty." (p. 69).

However, the book is not an elementary treatise on the peoples of Africa, for it presupposes some acquaintance with the aboriginal setting. To such a reader it will be stimulating and provocative.—CLARK WISSLER

Cactus. By Laura Adams Armer. Illustrated by Sidney Armer. 101 pp. New York: Frederick A. Stokes Co. 1934.

MRS. ARMER has prepared a handbook for the cactus fancier who stays at home and also for those who journey into the "land of little rain." While the former group includes a considerable number of enthusiasts, the latter includes most of us, for the lure of the desert seems to get about all who expose themselves to it.

The text, which consists of a single page, in good-sized legible type, for each kind of cactus, is divided into three parts;—first, a general description of the plant and its flowers and fruit, together with the Navajo Indian knowledge and uses of the cactus; second, "information for the cactus hunter"; and third, "botanical information." Thus it will be seen that the technical part, which is very brief, may be skipped by the non-scientific plant-lover.

Opposite each page of text, which treats of a single species, is a full-page drawing of the cactus described. These accurate illustrations were made by Sidney Armer.

Just fifty plants are described and illustrated in the little volume, all except four of which are cactuses from the giant cactus to the tiny button cactus. Among the four close companions of the cactuses, one wonders why the Joshua Tree was not included, but there would be no place to stop if one looked about for it in the rocks and sand of our southwestern desert.

Here is a most useful book, especially for those who wish to become acquainted with the conspicuous members of this bizarre and fascinating family of native American plants.

We suspect that Mrs. Armer became intrigued with the cactuses while making her superb motion picture of the Mountain Chant of the Navajos, and while gathering the material for her exquisite story, *Waterless Mountain*, which was the prize winner in Longman's Juvenile Fiction Contest in 1931, and which was awarded the Newberry Medal the same year.—CLYDE FISHER.

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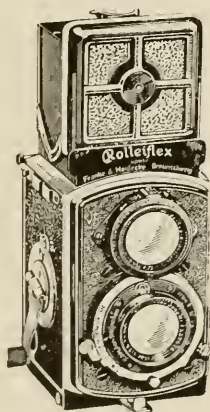
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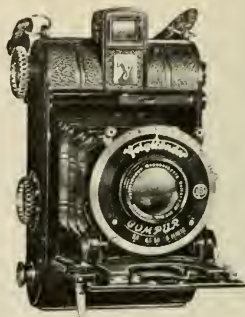
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| New Orleans | Oct. 11 | Oct. 11 | Soerabaya | Jan. 14 | |
| Colon | Oct. 16 | | Batavia | | Jan. 20 |
| Balboa | | Oct. 17 | Padang | Jan. 22 | Jan. 23 |
| Los Angeles | Oct. 25 | Oct. 26 | Oleleh | Jan. 25 | Jan. 25 |
| San Francisco | Oct. 27 | Oct. 28 | Colombo | Jan. 29 | |
| Hilo | Nov. 4 | Nov. 4 | Bombay | | Feb. 16 |
| Honolulu | Nov. 5 | Nov. 7 | Djibouti | Feb. 22 | Feb. 23 |
| Yokohama | Nov. 19 | Nov. 23 | Suez | Feb. 27 | |
| Kobe | Nov. 24 | Nov. 27 | Port Said | | Mar. 2 |
| Miyajima | Nov. 28 | Nov. 28 | Haifa | Mar. 3 | Mar. 5 |
| Beppu | Nov. 29 | Nov. 29 | Istanbul | Mar. 8 | Mar. 11 |
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| Saigon | Dec. 25 | Dec. 27 | Messina | Mar. 25 | Mar. 25 |
| Bangkok | Dec. 29 | Dec. 31 | Naples | Mar. 26 | Mar. 31 |
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|-------------|---------|---------|
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| Edinburgh | Apr. 21 | Apr. 22 |
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in college or just out of college have typified the group.

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Are the rooms satisfactory? Yes, in every way—all are outside, beds are comfortable, service is quiet and thorough, ventilation is ample.

The dining room? The "Oberkoch" I shall always remember for his lordly appearance, his genial smile, and above all for his delicious meals. They have been more elaborate than there was any need for, and besides with bouillon at ten, tea at four and sandwiches at ten-thirty P. M. thrown in.

Toilets and baths? They are European in character, are artificially lighted and ventilated, but are kept freshly painted and uniformly clean.

Entertainment? There has been a varied program of events—dancing, athletic contests, dinners, plays and

recitals. Ping Pong has been popular as also the canvas-lined pool which has been refilled daily. The Captain has been a true host. He has made us feel that the Gerolstein is our own.

Miscellaneous? The bar gives excellent service, I am assured by those who know. But it is not, however, a conspicuous feature. The lounge is comfortable and in constant use for reading, writing, checker and chess playing. Children on board have been taken into things in a homelike way. There is a barber shop, and provision for laundry service. And finally, being relatively long and broad for her height, the Gerolstein is a soft, easy-riding ship. There is very little vibration.

Mrs. M. and our three children join me in the above appraisal and we want to thank you cordially for our altogether delightful trip.

—M. R. M.

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September
1934

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Even the Captain, whom I assisted with his concert, and others, with whom I collaborated on an *Ilsestein Times* (in competition with the *New York Times*) extended their graciousness and kindness.

Frankly, I only hope and trust that my journey on the continent will be half as pleasant as this sailing on the SS. *Ilsestein*. The meals are excellent, and plenty (if not too much to eat), the service is excellent, and the sea is smooth. We even had a rainbow!

Again my hearty thanks for your pleasantry and courtesy to me.

THIS LETTER (unsolicited) was written to a member of the staff of the American Museum of Natural History. It is typical of hundreds of enthusiastic letters received from our passengers. Due to the great demand for this service, a third ship has been added to our fleet, operating regular schedules between New York, Havre and Antwerp.

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Blazing the Trail . . .

THE recent change in the appearance of *NATURAL HISTORY*'s pages has been so popular among our readers that we are delighted to be able to announce still another improvement. For fourteen years the magazine has appeared every second month. Beginning with this number, however, it will be published on the first of every month, except for July and August, and thus will appear ten times a year instead of six, as formerly.

♦ ♦

The People of the Philippines

For thirty-six years the Philippine Islands have been under American rule. Now, however, the reasonably near future will undoubtedly bring independence to this far eastern archipelago. But what are the chances for success in what will be, after all, a major experiment in the lives of a "subject" people? Who are the peoples who make up the inhabitants of this interesting island group? How will they play their part in the world?

Some of the questions that are being asked cannot be answered, of course, except by time. Answers to others, however, are known by certain highly competent students, and it is in an effort to present the known facts that we have asked Dr. Fay-Cooper Cole, of the University of Chicago, to prepare an article for the October number of *NATURAL HISTORY*.

Doctor Cole, from 1906 to 1923, was in charge of ethnological research in Malaysia for the Field Museum of Chicago. During most of this period he was also special investigator for the Philippine Bureau of Science. In these capacities he spent four years among the pagan tribes and visited all parts of the Archipelago. Since then he has made other visits to the Philippines, his most recent having been in October of last year. He is thus an observer who speaks with absolute authority, and current news from the Philippines will be far more understandable to those who read his article.

♦ ♦

The Drought

The newspapers are properly filled with news of the unparalleled drought in the United States, and we could hardly pretend to edit a natural history magazine without being conscious of the fact. It is with the news in mind, therefore, that we asked Mr. Charles Fitzhugh Talman, of the United States Weather Bureau, to write an article on droughts for the next number of *NATURAL HISTORY*. It will, we are certain, give our readers a new and deeper appreciation of the problems created by this tremendous calamity.

A Dog Story Dr. Roy Chapman Andrews, leader of the Central Asiatic Expeditions of the American Museum, was long the fortunate owner of a police dog named Wolf which attained a place of real importance in the world in which he lived, and many times appeared in the news dispatches from China. Unfortunately, Wolf has now gone to that "mysterious realm" to which all dogs must sometime go, but his story is more than worth telling. Consequently, Doctor Andrews has written it for our October number, and every lover of dogs will find it an account filled with unusual interest.

♦ ♦

The Account of a Fossil Hunter

Dr. George Gaylord Simpson, who headed the second Scarritt Patagonian Expedition, recently reappeared at the American Museum after returning from Patagonia by way, no less, of Moscow. And we hardly waited for him to fill his lungs with New York air before we demanded an article on his doings. Anyone who can write such a book as *Attending Marvels*, as he has done so recently, must not be permitted to keep his material from the pages of *NATURAL HISTORY*, and our next number will contain the article that we so insistently demanded. Patagonia becomes a fascinating place when Doctor Simpson describes it.

♦ ♦

Birds in a Garden

Dr. Frank M. Chapman is the dean of the scientific staff of the American Museum. That, however, is a distinction that time alone has brought about, and he has many other distinctions which we believe are infinitely more fascinating. To have made a life-long study of birds is something, but to have brought to that study so much of human understanding and to be able to transmit that understanding to others in what he writes, is accomplishment indeed. Last year he wrote of the birds that he observed in his garden in Florida, and for the next number he gives another account of these intimate and appealing friends of his.

♦ ♦

For Lack of Space

This page, when we grow enthusiastic, is amazingly easy to fill. We can only say, in the little space that remains, that Dr. George C. Vaillant will have another article on Central American native art in the next number, and that still other material is now being prepared.

**NATURAL
HISTORY**

SEPTEMBER
1934

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VOLUME XXXIV
No. 5

Quoth "THE RAVEN" (Bulletin of
the Virginia Society of Ornithology)
in December, 1933, concerning



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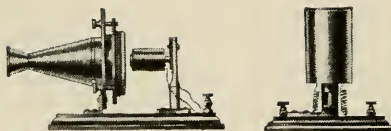
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NATURAL HISTORY

The Journal of the American Museum of Natural History

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Photograph by John T. Zimmer

In New Guinea Waters

The dugouts used by natives in parts of New Guinea, while frail-looking crafts, can safely carry a full complement of passengers or cargo. Their balance is unstable, and if they are heavily loaded, the water may flow through from bow to stern. Nevertheless, the natives are skilled boatmen and can manoeuvre these hollow logs with amazing success

(See "Camera Impressions of New Guinea," Page 447)

The Rebirth of the “Vanishing American”

by
Clark Wissler

Curator-in-Chief
of Anthropology,
American Museum

The Indian is still in the land. More than that, for over forty years his numbers have increased, and the time may not be distant when he will be more numerous than ever before in his troubled history

FROM Washington emanates the promise of a New Deal for the American Indian.

According to unofficial report the President is about to reverse the Indian policy of a century and start off in a new direction. Some of the proposals are to restore former Indian lands to tribal ownership; to abandon the idea of allotting individual lands; thus the Indian will cease to own land in the traditional manner of American citizens. Further, greatly to increase the present tribal lands by purchase or otherwise, each tribe or community is to be organized into a self-governing political unit and to operate its land under a legalized corporation; the original language, social customs, and religion of each tribe are to be rehabilitated. Just how much of this program will be authorized remains to be seen. No doubt some of the proposals are impracticable, but since our interest here is neither politics nor social reform, we offer no comment. The occasion, however, seems appropriate to review the history of the Indian during his contact with the white man. In other words, just what did happen to the American Indian under the Old Deal? Naturally, so brief an article as this can but open up the subject. Page upon page has

been printed concerning the Indian question, and it seems a little strange that among the heaps of books and pamphlets cluttering up the shelves of our libraries one looks in vain for a sober and exhaustive study of the Indian problem. Sooner or later, of course, such a history will be written. For the present, this short article may serve to outline certain of the major points of a long and complicated story.

Perhaps the best introduction to our subject will be an attempt to characterize the Old Deal. The historical information at hand shows the beginnings of our Indian policy to lie in British and French Colonial times. Anyway, this historical information indicates that both France and England recognized each tribe as an independent nation, and both of these Powers approached the chief of each such tiny state as on that level. The intent was to make each Indian chief feel that he was talking with a messenger direct from the throne and as king to king. The natural consequence of this attitude was that all questions of war, trade, and land were adjusted by treaties following the usual European pattern. President Washington followed this same procedure, his Secretary of State negotiating with the numerous petty chiefs who solemnly



Left:—A Northwest Coast Indian carving a canoe from a large cedar log on Neah Bay, Washington

Below:—Splint baskets were favorites with the Micmac Indians of Nova Scotia

Photograph by H. I. Smith



Ewing Galloway



In the circle:—The Indian turns trader.
Cherokee, North Carolina

Below:—A tipi makes a pleasant home, and many Indians still prefer one in summer



Ewing Galloway



Ewing Galloway

Hopi Indians in Arizona. Hopi Indian women are especially artistic in designing their heavy woolen blankets and earthenware pots

In the circle:—A sewing school at the Blackfoot Indian Reservation in Montana



Ewing Galloway

Above:—The old and the new in art. The father uses a pointed bone and earth paints; the son, up-to-date equipment



Right:—An Indian mission school at Fort Providence, Northwest Territories, Canada

*Photograph
by
O. S. Finnie*

affixed their marks to documents which they little understood. Our government did not abandon the treaty method until after 1870, when it put on record what had long been the reality, that all Indians were subjects of the government and in no sense independent nations. Canada, on the other hand, continued to negotiate treaties well into the present century. The important basic idea in this attitude was the recognition that, in theory, all lands were Indian owned and that the title to any such lands was extinguished by treaty only and when payments were made in accordance therewith. The Dutch began it by buying Manhattan. It mattered not if the tribe concerned had warred against the whites, killed many settlers, and destroyed much property. When at last they were defeated and made prisoners, the governments concerned still proceeded to negotiate a treaty of peace and to compensate the captives for lands taken from them. Further, no such tribe was forced to sell all of its lands, unless other lands were given in exchange, these lands having previously been released by other tribes. The plots of land still in possession of the Indians were then spoken of as "reserved" in the sense that they were not open to white settlement. Hence we have the term "Indian Reservation."

THE INDIAN'S ATTITUDE TOWARD LAND

With the foregoing outline in mind, let us turn for a moment to the Indian's attitude toward land. His original customs did not recognize individual ownership. In fact, he found great difficulty in understanding what was meant by the term. To him all lands were the common property of the tribe and each individual had equal rights therein except as otherwise determined by the proper tribal authority. This attitude of the Indian was recognized when payments were made, and so each year when annuities are due, the tribal census roll is added up and the sum due is divided by the total number of Indians living at that date. Each individual thus receives the same amount,

whether he be an infant in arms or an aged paralytic. Thus, if the annuity payment should be \$4 per capita, a family consisting of father, mother, and four children would receive \$24. Naturally, these amounts differed from tribe to tribe and from year to year.

THE PURPOSE OF RESERVATIONS

It is natural to assume that when the governments of the United States and Canada formulated their Indian policies they had certain objectives in mind. The history of the case indicates that it was always assumed that Indian reservations were to be so regulated that each tribe residing therein should quickly become a self-supporting and self-sufficient community. Of course, at the time these regulations were originated, a self-supporting community was conceived of as a farming community. Now every schoolboy knows that many Indians did not farm and that those who did were also hunters on a large scale. Naturally the white people of the time believed their way of life the most civilized, and so obviously the better. Consequently they assumed that, once settled on a reservation, all Indians would cheerfully turn into happy, prosperous farmers. We may smile at such naïve optimism, but our people were living for the most part on an advancing frontier, and one characteristic of frontier life is that it is sustained by optimism; the white men expected to do great things in this new country and in fact did, so why not the Indian? Looking back at the situation, it is easy to see one reason why things did not work out as expected. Each small Indian tribe, with its ancient communistic economy, was trying to retain its social identity in the midst of a crowd of competing individualists.

However, we began this article as a review of what happened to the Indian under the Old Deal. A satisfactory answer to such a question cannot be given in a few pages, because the subject is as complex as human life is everywhere. Yet we can seek information on a few points. Thus, we are in the



Left:—Mothers and children watching the arrival of the trading company steamer at Arctic Red River, Northwest Territories, Canada

Photograph by O. S. Finnie

Below:—A Seminole mother and child

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Papooses



Ewing Galloway

Above:—This little Winnebago is following in the road of the white man. His mother, though dressed in native fashion, clothes him in modern style and feeds him in approved scientific manner



Right:—Indian children have no end of fun riding about strapped to their mothers' backs

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Above:—A Navaho hogan and the ever present sheep and goats in Cañon de Chelly



Brown Bros.

Right:—A Ford becomes the covered wagon of the Navaho. Sia, New Mexico

Below:—The New Mexico village of Taos is famous, and its original style of architecture is well worth preserving

Pub. Photo Service



Photo from Ewing Galloway





Pub. Photo Service

Above:—Camp at the foot of the Rockies.
Assiniboin Indians, Canada

Right:—Flathead Indians make their first
attempt to live in the white man's house.
Note that the tipi still survives



Brown Bros.

Left:—One of the two kinds of houses
used by the Ojibway of the Great Lakes
country. Birch bark covers this type



*Courtesy,
National
Museum,
Ottawa*

Below:—The Seminole of Florida prefer to
keep their original style of housing

© Pub. Photo Service





How the Plains Indian population has changed. The first great drop shown was principally due to smallpox. Wars with the white men and a radical change in the Indians' way of life continued to reduce the population until 1895 or thereabouts. Since that time the population has shown a steady growth

habit of speaking of the Indian as a vanishing race. What is the truth about this? Will another century see the last Indian carried to the cemetery? The answer to this question seems a proper beginning to our task and naturally we first consult government records to see how many Indians are living today. The latest information to come to hand is as follows:

| | |
|---------------------|---------|
| United States | 320,454 |
| Canada | 122,911 |
| Total | 443,365 |

This is a small number of people, as populations run, since about as many Indians live in all this great area as white people in Buffalo, New York. Now if we knew how many Indians were here in 1492, the question could be settled at once, but here is where we meet with our first difficulty. Columbus did not see the coast of the United States, nor were many settlements made here, until after 1600, more than one hundred years later. Consequently, we cannot expect to find worth-while data as to the number of Indians residing in the country as a whole. In fact, it was not until 1800 that North America was sufficiently explored for writers and governments to

become acquainted with the various Indian tribes and so form an idea as to their numbers. About 1907 Mooney, a distinguished authority of the time, patiently searched the available records and books of travel, compiling original population estimates tribe by tribe. From these sources he finally decided that in the United States and Canada there were one million Indians in 1780. The reason for choosing this date was that a great smallpox epidemic swept over Central United States and Canada during the following year, and, according to reports of the time, carried away more than half of the population in the region. According to Mooney's estimates, about 100,000 died of this disease. Yet no tribe seems to have been wiped out completely, and in a few years most of them regained their normal population. As we have stated, Mooney estimated the original population as one million, and he saw no reason to believe that either more or less were living in the same territory in 1492. However, his estimates have been critically studied, and the general verdict is that he was too liberal—750,000 is the most probable number of Indians living in 1780.

Adult Indian women were originally more numerous than men, owing to the more hazardous lives led by the men. The elimination of tribal wars and the other changes that have taken place have brought about the change portrayed in this diagram, which gives the proportions of men to women among the Blackfoot Tribe of Canada



If we accept this as being close to the truth, it may be well to examine the original records for a more detailed picture as to this population. We understand populations only when we know how they are distributed over the country, since more people live in one place than another. For convenience, we have divided the continent into four main divisions and, from Mooney's population tables, have determined the number of Indians living in each. If we compare these with the number of square miles, we obtain the following results:

The Pacific Coast Belt—1 square mile per Indian.
 Atlantic Coast Area—3 square miles per Indian.
 Central and Plains Area—8 square miles per Indian.
 The Canadian Northwest—24 square miles per Indian.

The most striking point in this table is the wide variation in the density of the original Indian population. For example, on the Pacific Coast the population was 24 times as dense as in Northwestern Canada. Of course, this is a generalized statement and many local differences existed.

We are now ready for another question. If there were less than one million Indians in 1492 and again about the same number in 1780, why did they not increase? The preceding table shows us that more land was available to support an Indian in some parts of the country than in others. Perhaps here is the answer. Nature seems to have a way of reaching her objectives even though we are not sure we understand how it is done. Obviously animals and birds would have filled up the world long ago if some check were not in operation. Man seems to be a fauna which nature looks after in the same way. If there had been no check in population increase among the Indians, North America should have teemed with millions upon millions in 1492, but the Indians, living as they did, could not rise to such levels. Had they hit upon the mode of life we follow, doubtless some hundred million would have been here to meet Columbus.

These theoretical interpretations may be right or wrong, yet whatever may have been



Estimated density of Indian population in 1492. The arrow-heads in the squares show the relative density of population, with California supporting twenty-four times the population in a given area than northwestern Canada supported, and with the eastern seaboard and the Great Plains in intermediate stages of population density

the cause, we could parade before the reader statistics to show that many particular tribes had about the same number of members in 1880 as in 1780. Even though small-pox occasionally cut them down, they came back, in a short time, to near their former level. So we conclude that if America had not been discovered, the number of Indians would have remained fairly constant until there was a radical change in their modes of life.

We have previously referred to the general notions upon which governmental Indian policies were based, and in this connection it is curious to note that even to the present our Indian policy seems to have taken it for granted that the tribes would not increase, else why should the Government merely have set aside land regarded as sufficient to meet the needs of the moment? Apparently the New Deal does take this into account, since it is proposed to buy additional land, possibly displacing white farmers to make room for more Indians.

Now we turn back to the original question and note that if there were 750,000 Indians in 1780, and at present about 440,000, then less than forty per cent have been lost.



Ewing Galloway

Above:—Many Indians served in the World War. This photograph shows several members of the Potawatomi on Armistice Day in Laurence, Kansas. The tribal regalia is quite a contrast to the somber uniform of a United States infantryman

Ewing Galloway



Ewing Galloway



Yellow Head, a Black-foot chief. Undoubtedly the great interest that peoples all over the world have taken in the American Indian is due to the fact that picturesqueness, intelligence, and bravery are qualities so often combined in these red natives of America

Montana Black-
foot Indians on
the move



Publishers Photo Service

Left:—A fur traders' fort on the
Missouri River in 1834

*Drawing
by
Bodmer*



Below:—Assiniboin and Cree Indi-
ans making a surprise attack on
Blackfoot Indians camped outside the
trading post of Fort Mackenzie,
Montana, in 1833. Drawing by
Bodmer, an eye-witness



Most of the Indians were settled on reservations between 1840–1880; those in Canada somewhat later than in the United States. It is then a question as to when this loss in population occurred, before or after reservation life? Before presenting the necessary statistics to answer this question, we should take a look at the history of Indian contact. So far, the history of every Indian tribe we have reviewed falls naturally into three periods.

- (1) The period of trade in furs and other commodities.
- (2) Encroaching white settlement and Indian wars
- (3) Reservation life

Since in both the United States and Canada settlements advanced steadily from east to west, the actual dates for these periods will vary with the geographical positions of the tribes concerned.

A PERIOD OF ECONOMIC PROSPERITY

Naturally there are some contrasts in Indian life during these periods. In fur trade times the Indian maintained his own tribal organization, moved about freely within his recognized territory, and was able to buy European goods in proportion to his industry and climatic conditions. True, he was under the necessity of guarding against attacks to take his scalp, massacre his family, run away with his horses, etc., but he was usually ready to retaliate at every opportunity. On the whole, his life was richer and more interesting than before the whites came upon the scene. He was now able to provide himself with firearms, steel tools, horses, and many other conveniences, all of which lightened the drudgery of daily routine, raised his standard of living, increased his ability to travel, and subjected him to considerable intellectual stimulus from contact with a new race and a new culture. In general, this was a period of economic and political expansion in Indian life.

However, like all things in human life, the fur trade period eventually started on

the down grade. The advancing frontier destroyed hunting and trapping grounds and threatened to take possession of lands regarded by Indians as their own. In such a situation war was inevitable. The results of these conflicts were always the same in that sooner or later the tribe was hopelessly defeated and forced to settle on a reservation, which, for a time at least, took the form of a prison camp. As may be expected, the Indians were now in a state of economic collapse, since they no longer produced furs nor hunted for food. Many looked upon the situation as hopeless. It is recorded that in one tribe, at least, many young men committed suicide.

In general it must be said that the governments of both Canada and the United States took a humane view of the situation, providing food and encouragement. As previously stated, all Indians were expected to support themselves by farming. Furthermore, they were encouraged to adopt the housing, clothing, and other material modes of life traditional to white people. School-houses were erected and churches built. The uniformity of this historical cycle warrants us in looking upon it as the key to the situation.

THE DECREASE IN POPULATION

Want of space forbids recounting the tragedy and heroism of the struggle to survive under the reservation system, and so we turn back to the original question as to what happened to the Indian population during these successive historical periods. Theoretically we might assume that during the fur trade period the Indian population would increase, or at least, hold its own. As previously indicated, this is what did happen. On the other hand, we should expect that the period of war would reduce population, not only by actual casualties, but by the necessary privation and discouragement accompanying defeat. Apparently this happened also, since we note from the records of the United States government that the total number of Indians on reservations at

A Blackfoot Ceremony



Courtesy, Canadian National Railways

Burning Buffalo Grass

All Plains Indians love the rolling grasslands as truly as sailors love the sea. Here some Blackfoot Indians in Canada, awed by the great stretches of land and sky, are offering prayers and sacrifices to the great mysteries of the plains. This ceremony is held at the time of the first full moon in June



Ewing Galloway

Above:—Pima Indians clearing new lands for farming in Arizona. Indians are operating the outfit under the supervision of the United States Land Subjugation Project



Photograph by H. I. Smith

Above:—An Indian Village wharf at Queen Charlotte Islands. These modern boats are all owned by Indians



Brown Bros.

Left:—Indian labor is often employed in the building of roads

Brown Bros.

Flathead Indians harvesting wheat. Indians in their native state were usually hunters and not agriculturists, yet they have taken reasonably well to this new occupation



STANDING ROCK AGENCY



Photograph by Clyde Fisher

An Alaskan fishing camp. Dried fish forms a large part of the food of these natives



Brown Bros.

Below:—A Navaho blanket weaver. Different tribes have developed various arts and crafts, some to a very high point of perfection. The handwork of few however, can equal the excellence of the handsome woolen blankets woven by these Indians of the Southwest

Pub. Photo Service



The main building at Standing Rock Indian Agency, North Dakota. Some of the office employees are Indians

Below:—A Chilcotin Indian cowboy. Indians love horses and are efficient herders

Photograph by H. I. Smith



three different periods was as follows:

| | |
|-----------|---------|
| 1865..... | 294,574 |
| 1891..... | 246,834 |
| 1933..... | 320,454 |

The estimated number of Indians in the United States in 1780 was 636,750 and the difference between this estimate and that for 1865 probably indicates the losses due to disease, and to war and its accompaniments. However, we note that in 1891 the reservation Indian population reached its lowest point. In other words, from the time the Indians were placed on reservations up to 1891, there was a more or less steady decline in numbers. On the other hand, after that date they increased slowly at first and then at an accelerating rate.

At present the birth rate among the United States Indians is much higher than that for the total white population, but on the other hand, the death rates for Indian children are also much higher than for whites. Tuberculosis is prevalent among the Indians, and as elsewhere, causes a high death rate among young people. It is because so many young Indians die before raising families that their numbers have not increased more rapidly. However, advances are being made in the care of Indian health and it stands to reason that if the Indian birth rate continues high and the death rate among the young is materially lowered, the increase in Indian population will be greatly accelerated.

TRIBES THAT INCREASED

If one turns to a population table for Plains Indians, it is observable that not all Indian tribes lost population at the same rate. For example, the Dakota-Sioux seem now more numerous than ever before. Mooney estimated that in 1780 they numbered 25,000, the reservation census in 1860 listed them at 24,000, and at present they are said to number 35,000. Thus it appears that they not only maintained their numbers, but also are now more numerous than ever. This is not because they were not subjected to the same hardships as other Indians, for

they engaged in bloody wars with the whites and found difficulty in adjusting themselves to reservation life. The Navaho furnish another example, since in 1869 they were estimated at 9,000, whereas at present they exceed 22,000 in number. Some authorities place the present Navaho population at a much higher figure, but even at a conservative estimate, it is certain that they have more than doubled since 1869 and are now said to be increasing faster than ever.

In conclusion we should note the mixed-blood factor. Practically all mixed bloods are listed as Indians and given full tribal rights. Possibly had there been no such mixture the loss in Indian population would have been greater. At present the United States Indian Service lists about 40 per cent of the Indians as being of mixed blood. We have no reliable data as to whether intermarriage with whites is increasing or decreasing, but the latter seems probable. The New Deal is expected to discourage such unions. As to our main problem, before the white man intruded, Indian population seems to have reached a balance, and would have remained much the same until such time as the Indians made drastic changes in their modes of life. During the early years of contact, a few white men went among the Indians to trade.

As trade increased, the Indians prospered and held their own, but as more white men came, hunting lands were taken for homesteads, resulting ultimately in war and in the economic collapse of the Indian. Here the Indians lost in numbers from lack of food, disease, and casualties. The loss was nearly 40 per cent. Now crushed and hopelessly defeated, the Indians began reservation life to learn farming and other white ways. Under the stress of such a calamity, losses in population continued for a time, but eventually adjustment to the new conditions got under way and the population started on the up grade. With a New Deal to accelerate this increase, there should soon be more Indians in the United States and Canada than ever before in the history of these appealing people.

Nest Building—New Style

How the birds of a wild life sanctuary in Connecticut followed the example of a pair of orioles that were willing to experiment with new and unconventional materials

by

Henry Smith Williams

With 29 paintings,
etchings, and
drawings by
the author

AT "Three Brooks," our Wild Life Sanctuary near Roxbury, Connecticut, Mrs. Williams and I have had ten years' experience in the observation of a colony of birds whose nest-building activities have come, through our coöperation, to have a novel character. Our Baltimore orioles in particular (and to a less extent our kingbirds, robins, and waxwings, and a few others) have been induced to depart most radically, in the matter of the selection of nest-building material, from the practices of the thousands of generations of their ancestors. The nests that our orioles now build are constructed almost or quite exclusively of soft woolen yarns. The instinct that causes orioles in general to gather natural strips of vegetable fiber—bark of milkweed, grapevine, and the like—seems altogether in abeyance.

These anomalous nests are mostly (in recent years) much larger than nests of the species of ordinary or normal type, and, far from being hidden or camouflaged, many of them are glowing masses of color, insistently visible sometimes for hundreds of yards. In building such structures, the birds seem to have departed very widely indeed from the "instinctive" practices of orioles in general, and of their own direct ancestors of any year prior to 1923.

In viewing our collection of nests in series, one is instantly struck with the idea of progress. The nests of 1931 and 1932, for example, are so large, so spectacular, as to

throw the nests of 1926 quite into the shade—though some of the latter, as contrasted with normal nests of any other region, are striking indeed. Moreover, only one nest of the first score or more utilized our man-made offerings exclusively. Even after a stage had been reached where the entire outer structure was of yarn, a lining of natural materials would be placed at the bottom of the pouch. Not until the eighth year of the experiment did it become usual to substitute cotton for crude fiber—so that the entire structure was made of material we supplied, with perhaps the incorporation of a few horsehairs, to give requisite solidity to the walls of the cradle.

In the course of ten seasons, however, the transformation has been complete. Even in 1930, of eleven orioles' nests built within one hundred yards of our arbor (the chief source of supply of yarns), only one utilized any considerable proportion of natural materials. In nests of succeeding years, to date, soft yarns have had exclusive preference. And the average nest of 1930, '31, or '32 utilized enough yarn to have built at least three average nests of any year prior to 1927.

In giving these details, I am leading up to the question: Can one properly or logically explain such a change of habit, involving an entire colony of orioles for a period of ten generations, in terms of "instinct"? It is freely admitted that instinct fully explains the tendency of orioles in general (including

those of our colony prior to 1923) to gather strips of vegetable fiber and weave it into suspended nests. But here we have a colony of birds that have abrogated that instinct. These iconoclasts show individual preferences as to texture of materials and very decided differences of taste as to color. The concensus among them now (but not at first) is that soft woolen yarns are preferable to any other material.

In two recent years, all individuals but two have shown a preference for white yarn (though objecting not at all to the inclusion of red or blue or orange); but this fashion prevailed only after several years during which no individual used white yarn exclusively, or even predominantly.

A not dissimilar caprice of fashion (it is impossible to avoid human terms in describing the activities of our "educated" birds) dictated in 1930, for the first time, that nests should all be displayed at the very tops of trees—whereas many of the most spectacular creations of earlier years had been swung within from eight to twelve feet of the ground.

All this seems to suggest what may fairly be called "intelligent" choice. Still the point might be debatable. Instinct is a word of wide connotations. Some specific individual activities, however, really seem to involve mental action of a type to which the word "reason" can hardly be denied.

For example, Madam Oriole of the west maple, in 1931 (a year-old bird as shown by the color of her head), made unsuccessful efforts at nest-building on her first and second trials. Then by selecting only long strands of yarn—four and a half feet by actual measurement—she constructed one of the deepest and most commodious nests of the entire series.

In this case I had full opportunity to make what might be called psychological tests (elsewhere recorded in detail), proving that the bird, after making a large, abortive nest, with strands of yarn about two feet long, realized clearly that she *must* have longer strands in order to get requisite depth for her projected nest-pouch. When three

long strands were hung at the ends and center of a long row of shorter strands on a pole, she selected the long strands sequentially without a moment's hesitation—and declined to touch the others, even when further supplies of the kind she wanted were withheld for a time. The tests were repeated and varied, until I was fully convinced that the bird knew *what* she wanted. Need we doubt that she knew *why* she wanted it?

In three other instances, inexperienced members of our colony have similarly failed to get proper depth in their first effort at nest-building; and each time the neophyte has profited instantly by her mistake, building at second effort a nest of exceptional depth, such as otherwise is seldom achieved except by an experienced matron in her second or third season. Thus the observation that our "educated" orioles may learn directly and definitely from *individual* experience, and profit by their own errors, is four times fortified.

AMAZING KINGBIRDS

Nor is it orioles alone that have shown capacity to choose as individuals and to break with racial tradition. For five years, to be sure, no member of another species emulated the orioles in accepting our artificial nest-building materials. But in 1928 a kingbird adopted the new custom and, with the zeal of the neophyte, outdid the orioles themselves.

Her nest, with its astonishing display of white-cloth-strip drapery, is still one of the most spectacular exhibits of our collection. Considered as a bird's nest, it seems so downright absurd a contrivance, that it never fails to arouse hilarity whenever I exhibit it. The painting here reproduced does scant justice to the display it made in the little apple tree where it originally hung, because the canvas was not large enough to show the numberless auxiliary strips of cloth that were entangled on neighboring branches.

The builder of this remarkable domicile

Cedar Waxwings



The waxwings did not use any artificial nest-building materials extensively until the season of 1931, nine years after the first oriole started the fashion, and four years after the first kingbird had followed suit. But when they did decide to use the soft woolen yarns, this pair made amends for past neglect. They seemed to feel that they could not have too much of a good thing, and the cradle here shown is commonly referred to as the "incredible" nest



Robins

The robins, once they decided to emulate the orioles, set to work with enthusiasm. They gathered quantities of yarn, seemingly regardless of color, and deposited it in the selected tree-crotch. They then went ahead and built an old-fashioned robin's nest, mud and all, on top of the tangled mass. Evidently they had no clear notion as to what the yarn-business was all about



Orioles



The Baltimore orioles were the original users of the artificial materials, and after a few seasons they decided to use soft woolen yarns exclusively. This nest was built in 1931, when the fashion of the season called for white yarn. As a compromise, strands of white and scarlet tied together were accepted. In the treetop, white reflects the surrounding foliage, and is less conspicuous than might be expected



Kingbirds

This was the first bird other than an oriole to use our artificial materials in quantity for nest-building. This kingbird, adopting the custom in 1928, chose strips of white cloth in preference to the strands of yarn that the orioles had come to favor. Once she had started, the bird seemed obsessed by the novel material. The four color plates in this series are reproduced by courtesy of *Good Housekeeping*



disappeared while her nestlings were immature. We never knew what happened to her, but we were assured that if some predator took her life, the tragedy had no relation to the spectacular nest, because the nestlings were not molested. They did not flourish, however,—perhaps the surviving parent was unequal to the task of caring for them unaided,—and died before coming to maturity.

Next season (1929) the male convoyed his new mate to a site a hundred yards away, just beyond the pond, selecting an apple tree even smaller than the one that had borne the marvelous but ill-fated cradle of the year before. The new mate showed at once her individuality of temperament, in selection of nest-building material. There was the usual variety of textiles, permitting freedom of choice to suit all tastes. But for this young matron only one of these had any appeal. Strands of soft, white, woolen yarn alone took her fancy. The strips of cotton cloth that had so delighted her predecessor were totally ignored. She accepted the yarn with eagerness and in quantity, and wove it into a compact structure, with just enough old-fashioned materials—grass stems and rootlets—to give it solidity.

It was a less spectacular cradle than the cloth-strip creation, but hardly less anomalous. Certainly it showed a wide departure from kingbird traditions.

Next season a second white-yarn nest, almost precisely like the first, was built on a fork of the same tree, not two feet away from the severed branch that had borne the other—in fact, on a remaining fork of the same limb. No better evidence could be asked of a bird's return to the same building site (were the matter in doubt, as of course it is not) than is afforded by comparison of these two nests—closely similar, but unlike any other birds' nest—built in successive years on the same branch of a particular tree.

The builder of these dainty nests did not return the third season. But the yarn-using tradition she had established did not vanish with her. Two other nest-builders of the species, both of which may well have been

her daughters, showed their appreciation of soft woolen yarns, and garnered this material in profusion. The nests they built, however, were very different indeed in appearance from their white prototypes. Each builder seemed to revel in gathering a superabundance of material (as the first kingbird innovator of 1928 had done), and each used only one end of any strand of yarn for practical constructive purposes, the remainder dangling to a distance of two or even three feet below, or being entangled with neighboring branches. Doubtless this was largely accident or lack of craftsmanship (putting aside the question of "design"). But in any event, the result, in each case, was the creation of a cradle of positively startling character.

TWO SPECTACULAR COLOR CREATIONS

To add to the interest, the two nests were totally different in color scheme, one being preponderantly red, as viewed from a distance; the other as preponderantly blue. In the case of the latter, I had opportunity to watch the actual selection of building material, from a distance of only five feet, as I sat behind a screen in my studio. The strands of yarn of various colors were strung through staples along the top of a horizontal chestnut pole that served as a railing. As is my custom, I put strands of different colors together, to test the birds' color sense.

The lover of blue was seen to select and pull out one blue strand after another, from successive staples, leaving yarns of other colors. The test would have been definitive had not the bird taken also a few white strands. The red and yellow strands that appear dangling or tangled near the nest were originally tied to the blue (or by exception white) strands that the bird selected. Like the orioles under similar circumstances, she either did not mind the presence of the (to her) less attractive color, or else submitted to its presence as an unavoidable evil for which the much-desired blue yarn more than compensated.

The building of the blue nest involved an

Oriole's nest of yarn of varied colors, built in 1925; probably a second creation of the original genius of 1923, shown at the right.

Drypoint etching



The original oriole genius of 1923 at work. Aquatint etching

Eight Years of

The original oriole genius above, whose initiative was responsible for the entire ten-year experiment in coöperative nest-building, was avid of artificial textiles of almost every type—strips of cloth, string, ribbons, but in particular soft woolen yarns. She took materials of varied



Oriole's nest of 1927, exclusively of heavy woolen yarns of varied colors, predominantly dull orange. Occupied by house wrens, after being vacated by the oriole brood. Drypoint etching



Many-hued oriole's nest of 1930. Mezzotint engraving



Oriole's red and white nest
of 1926. Line etching

First all-white yarn oriole's nest,
1929. This nest has a double
entrance. The same bird built
another all-white nest with
double entrance the following
year. Line etching



Nest Building

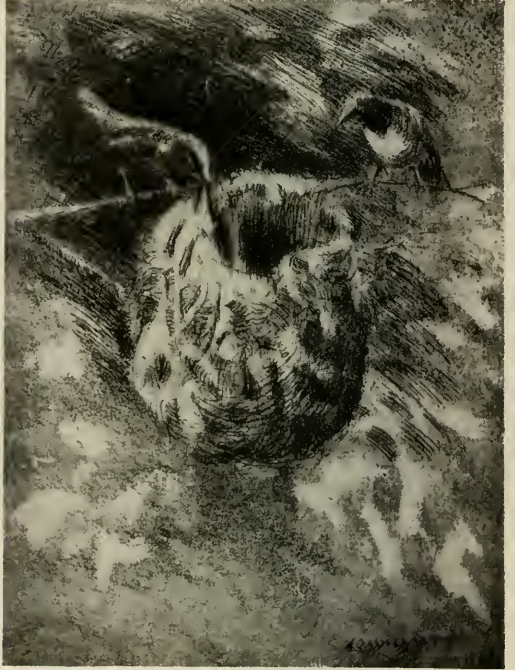
colors, but accepted scarlet ribbons of large size
only when attached to the yarns she especially
coveted. In the maple tree where it swung, the
body of the nest glowed like an orchid, and the
streamers of scarlet, yellow, and white, dangling
two feet below, made a singular spectacle



Oriole's blue and gold nest of
1928. Very neatly and com-
pactly woven. Other orioles of
the same year, selecting from the
same yarn-supply, chose red,
white, and dark-orange strands.
Aquatint etching

Oriole's white nest of 1931.
Soft-ground etching

Orioles of 1927. Nest made partly of natural fiber, with elaborate trimmings of pink yarn and white cloth. A really beautiful cradle, glowing with color. It was excelled artistically, however, by two other nests of the same season, in neighboring trees



Above:—Oriole of 1928. Largely natural fiber, conspicuously decorated with pink and white cloth, strings, and yarn. Line etching

Below:—Kingbirds of 1929. White yarn nest, which was duplicated the following year on a near-by branch of the same apple tree.

Painting





Waxwings of 1932. Perhaps the same bird that built the spectacular nest of 1931, in the same large maple tree—an unusual selection, an apple or a pear tree being commonly chosen. This nest is imbedded in a tangled mass of yarn, chiefly of rather bright orange intermingled with white. Aquatint etching



Above:— Orioles of 1930, in sycamore tree. Thick-walled nest of yarn of varied pale colors—amber, pink, yellow, white. Drypoint etching
Right:—Kingbirds of 1931. Red and white yarn woven into the nest and dangling; contrasting strikingly with the kingbird's blue nest in a neighboring tree. Mezzotint engraving

element of domestic disharmony that to an onlooker was of extraordinary interest. It grew out of an apparent difference of opinion as to the best building site. Nest-making began in a small half-dead apple tree—and finished there. But there was an interlude during which the builder (the female, of course) apparently tired of struggles with tangled yarn in dead branches, and shifted to another tree, fifty yards away. She got a fair start on another nest before protests of her husband availed to bring her back to the original tree; and the conclusive protest took the form of a literal attack in the air on the yarn-laden feminist—driving her back at the point of the bill. Even then she did not resume work on the first structure, but chose another branch. And there in due course the blue nest that is one of the most spectacular of all bird creations took form and was carried to completion.

Of course it is familiar knowledge that the male usually selects the building site. But here was novel evidence that he may physically enforce his authority. It will be noted, however, that the edict concerned only the *tree*. The helpmate was apparently free to select the particular *branch* she thought most suitable. We may plausibly assume that the same arrangement holds with oriole households, as the female there also is the exclusive nest-builder. The head of the family, chooser and defender of the home tree, apparently knows nothing about the art of cradle making.

BIRDS THAT S W BLUE

It has been assumed by some observers that birds cannot "see" blue. This kingbird not only recognized blue, as distinguished from other colors, but refused all substitutes—except an occasional strand of white. An oriole of 1929 selected blue and red yarn in about equal proportions; and another oriole built nests in successive years, 1932-33, on the same hickory branch, using blue and white strands only. In the latter case, many blue strands were adjusted together, as if by design, but perhaps even

this does not quite prove that the bird distinguished between blue and white—which is really the point at issue. Other orioles, however, have clearly demonstrated that they could so distinguish.

The tests were made by mixing blue and white strands of yarn, through the same staple-loop, during the season of 1931, when our orioles had decided that white yarn alone should be taken for nest-building.

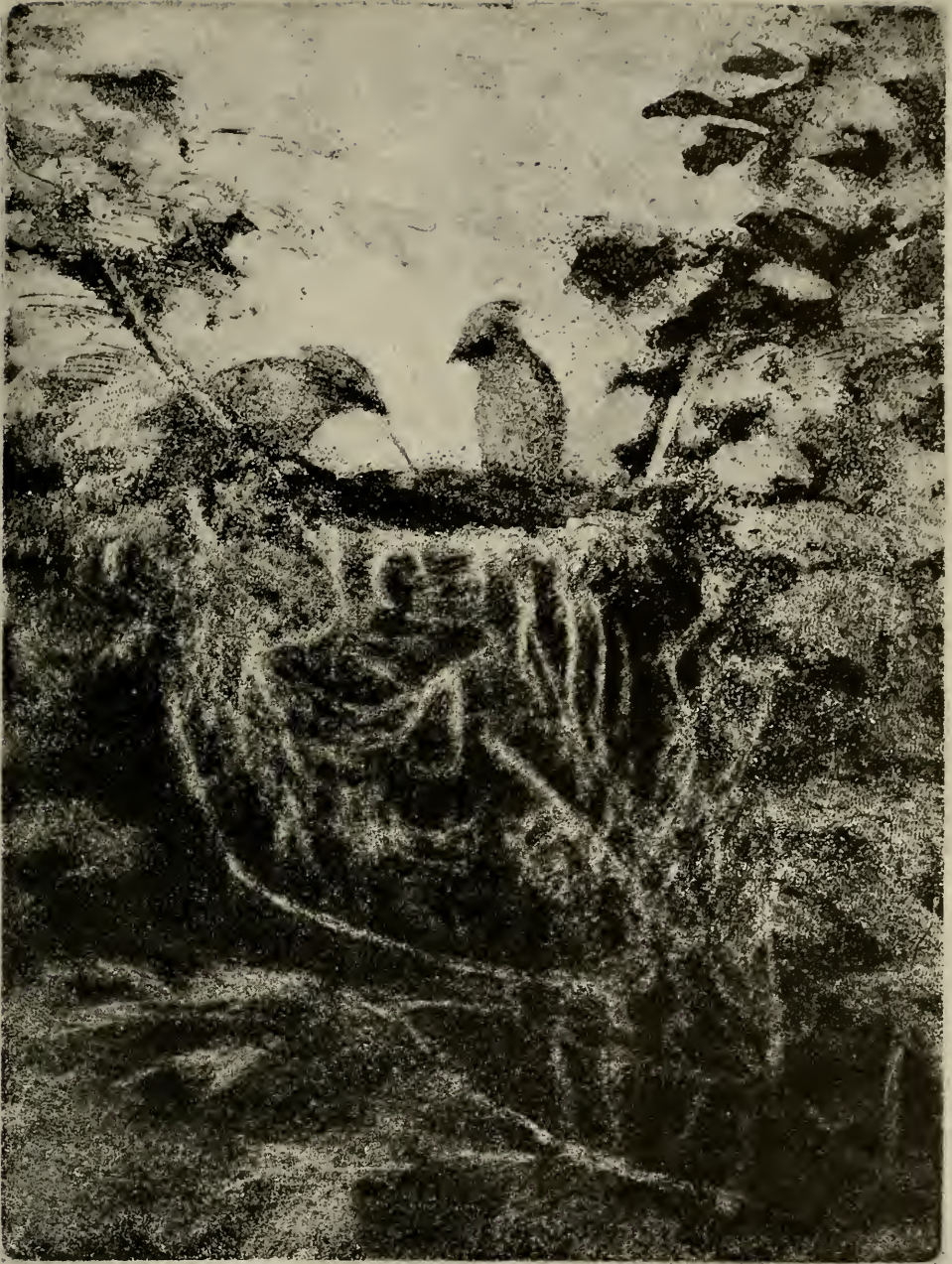
DISCRIMINATION

Not one bird merely, but three or four, showed scores of times in the aggregate, the clearest discrimination between white strands of yarn and strands of all other colors, blue included.

A strand of white, enmeshed with multiple strands of any or all colors, would be singled out and extracted with altogether convincing finality. I had planned to have red nests that season; and I got them—but only by subterfuge. I tied strands of the scarlet the birds did not want to the white they did want. That had been my original method at the outset of the experiment. The birds accepted the compromise. They flew off with white yarn (never with blue) in their bills, the scarlet streaming behind. Mostly they left the scarlet part of the strand dangling, with most striking effect, after incorporating the white part into the nest-structure.

I have named 1931 as the season when this passion for white yarn obsessed our orioles. For two years prior to that, one oriole, and one only, had declined to accept any but pure white strands of yarn. This had seemed an individual peculiarity of taste, but apparently it served as the basis or example for a new fashion.

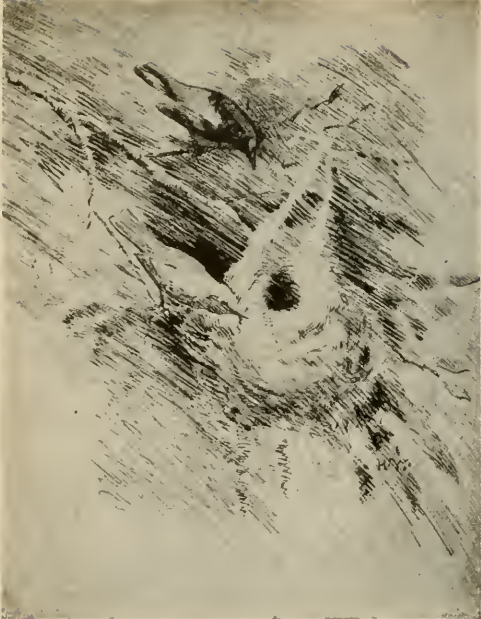
The first nest of this iconoclast was built in the season of 1929, after other orioles' nests of that season were finished (but not the kingbird's creation of white yarn—from the same source). The second nest, for the season of 1930, was built early, as is usual with birds other than yearlings, and may have been observed by the builders of the



Henry Smith Cobble
1943

A pear tree nest of 1931, ornamented with a mass of scarlet yarn, incorporated with grass stems and fibers of the usual natural materials. Less spectacular than the "incredible" nest of the same year, but very striking. A third waxwing's nest, in a near-by apple tree, used yarns of pale colors, mostly purloined from the nest of a kingbird in the owner's absence. In each case, the body of the nest was saddled on a limb, and depended largely on natural materials rather than the yarn for its solidity. Nevertheless, surprising craftsmanship was shown in handling the yarn. Aquatint and mezzotint

Cedar Waxwings



Above:—Orioles of 1927. Exceedingly beautiful nest of very bright-colored yarns—pink, red, lavender, blue, white—marvelously woven. Artificial materials exclusively; decorated at either side with a feather!

Drypoint etching

Below:—Orioles of 1931. A deep, heavy, and wonderfully woven nest of white yarn, with scarlet trimmings. The weaving, stitching, and knot-tying reveal bird craftsmanship at its best. Aquatint etching

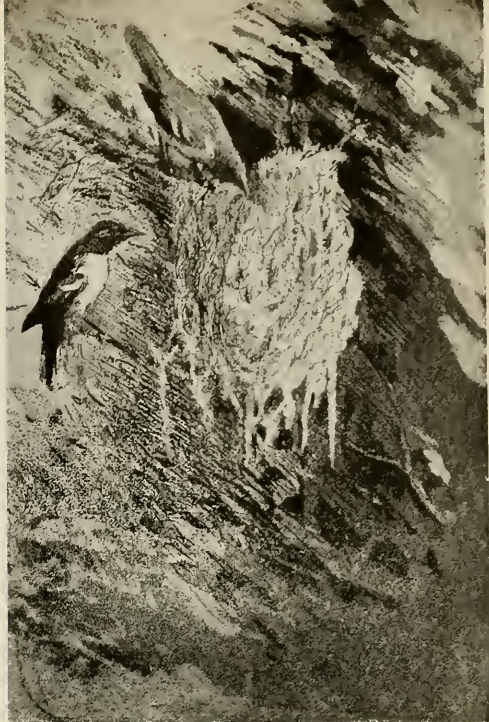


Kingbird of 1931. Described in the text as the "blue nest," this structure is among the most remarkable of bird cradles. In addition to the superabundance of yarn, mostly blue in color, the bird eagerly accepted bountiful supplies of white cotton, and molded them with her body and feet, to form the chief structure of the body of the nest, incorporating just enough horse-hair and small rootlets, along with the the yarn, to give firmness to the amazingly deep and beautifully hemispherical cradle. No other member of the species, and no other bird but an oriole, within Doctor Williams' experience, has approached this kingbird in craftsmanship. Drypoint etching



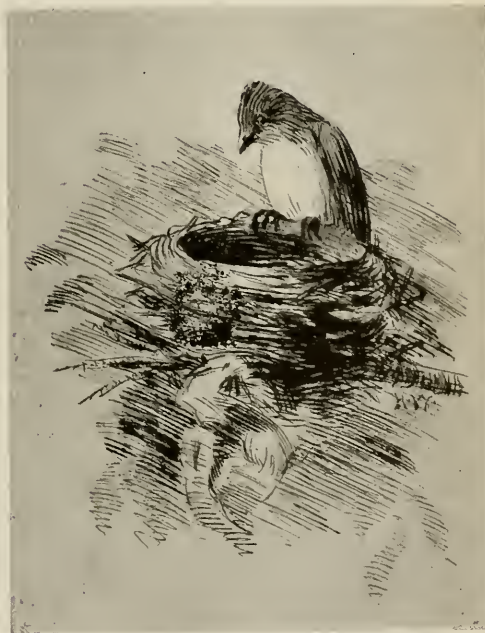
and

Kingbirds



Orioles of 1929. The nest is of crimson and blue yarn, with some strands of white. Although having the outward appearance of completion, it was never occupied
Aquatint etching

*Below:—*Kingbird of 1930. A relatively unspectacular but very neat nest, largely of natural materials, but incorporating strips of cloth and some yarn. Drypoint etching



Orioles of 1926. The most artistic of the bird cradles of that season. It is a well-woven structure of string and yarns, mostly gray, with numerous strands of crimson. This nest, like others of the earlier series, was strapped to a larger limb than the ones orioles ordinarily select. The following year several orioles mastered the problem of knotting strands of yarn on small terminal twigs. Painting

neighboring nests (to the number of ten), who in any event, showed a propensity to favor yarns of light colors, though not holding exclusively to white. The very nearest one, indeed, utilized red and blue yarn in about equal proportions with white, producing a nest famous in our annals as the "Tricolor."

But in 1931, though the original protagonist of white was no longer with us, her example had seemingly borne fruit, for one builder after another (as just related) came to the arbor with the desire for white yarn, and white only, firmly implanted in her mind. Not an oriole of our colony that season *voluntarily* took a single strand of yarn other than white in color.

EARLIER LOVERS OF COLOR

To appreciate the bearing of all this, it must be understood that our orioles had been accustomed, for five years prior to 1931, to select yarns of many and varied colors, and to use them with the utmost freedom in building the nests that now comprise the middle series of specimens in our collection.

In the 1927 series of three nests nearest the house, one is a rich, heavy, textile of dull orange, red, and deep blue; the second has a dark matrix of natural fiber, with pink and white ornamentation about the entrance; and the third is an amazingly woven globular structure which, swung from the tip of an apple branch, glowed in the sun like a gigantic orchid—brilliant with reds, blues, lavender, and yellow. Hung in the open, scarcely shielded by leaves, only ten feet from the ground, blatantly visible from every side.

One nest of 1928 is crimson, blue, and white; another, pale blue and gold; a third bright red and white intermingled; a fourth, red and orange. In the two succeeding years the color displays were varied and striking. But the climax came in 1931, when, in addition to the kingbirds already cited, robins, catbirds, and cedar waxwings suddenly decided to give our yarns a trial.

Collectively, they staged a great show. In early June, within a hundred yards of the

house, you could not avoid seeing: (a) four nests of the Baltimore oriole of relatively enormous size, made of pure white yarn, with or without scarlet trimming (one about half scarlet); (b) five robins' nests decorated—two of them flamboyantly—with masses of red, white, orange, and blue yarn; (c) two kingbirds' nests prodigal of color, one red and white, the other blue and white with red and orange trimmings; (d) two catbirds' nests decorated with orange yarn, while strands of sundry colors dangled from surrounding briers; (e) nests of redstart and least flycatcher made almost exclusively of white cotton; and (f) three cedar waxwings' nests, one decorated conspicuously with orange, the second resplendent in red, and the third a gigantic cat's-cradle of yarn of many colors—spectrum yellow, blue, lavender, white, red—so draped and woven as to constitute an "incredible" structure.

KEEPING UP WITH THE JONESES

There is hardly the remotest chance that robin or kingbird or waxwing would have built nests in the least like those of our collection had not the builders observed other birds, orioles at first, gathering and using the new materials. Even when they have gathered the material, many of the copyists do not know what they ought to do with it. The robins in particular never use the yarns effectively as building material proper. They deposit a mass of yarn, of whatever color chances to be available in the tree-crotch chosen for a nest-site (often leaving as much more dangling from neighboring branches), and then go ahead and build an old-fashioned robin's nest, mud and all, on top of it.

In a word, it is only the orioles that really weave nests of yarn. The imitators incorporate yarn with other materials, or leave it dangling, and produce extraordinary decorative—or bizarre—effects. But for the most part they obviously have no clear notion as to why they are using the strange textiles. They merely feel that they *must* follow the fashion, at whatever cost.

Camera Impressions of New Guinea



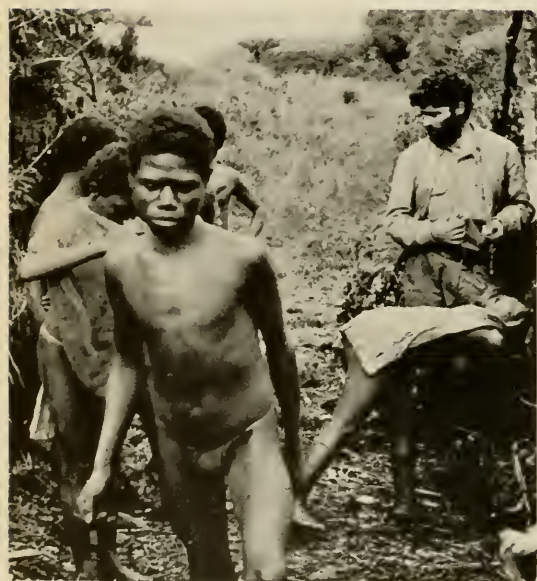
A Hanuabada *lakatoi* going
west for sago and betel nut

From the Record of an Expedition

The 1933-4 New Guinea Expedition of the American Museum left the United States in January, 1933, for Papua, in order to collect high mountain fauna and flora. The party consisted of Richard Archbold, leader and mammalogist; A. L. Rand, ornithologist; L. J. Brass, botanist; and C. J. Adamson, in charge of transport. The latter two joined the expedition in Papua. The expedition made an excellent collection on Mt. Albert Edward and spent two months in the western part of the territory before returning in June, 1934. The photographs in this series were taken by Mr. Archbold, Mr. Brass and Mr. R. V. Oldham



The Expedition in



Mr. Archbold, the leader of the expedition, buying food from the natives at the 9000-foot camp on Murray Pass



Messrs. Rand and Archbold on the central peak of Mt. Albert Edward with Mr. Adamson looking toward the Eastern Peak



Above:—Mr. Adamson's launch arriving at Boto, the limit of navigation

Right:—Loading a double canoe with the expedition's gear and supplies for the six months' trip into the mountains



the Field

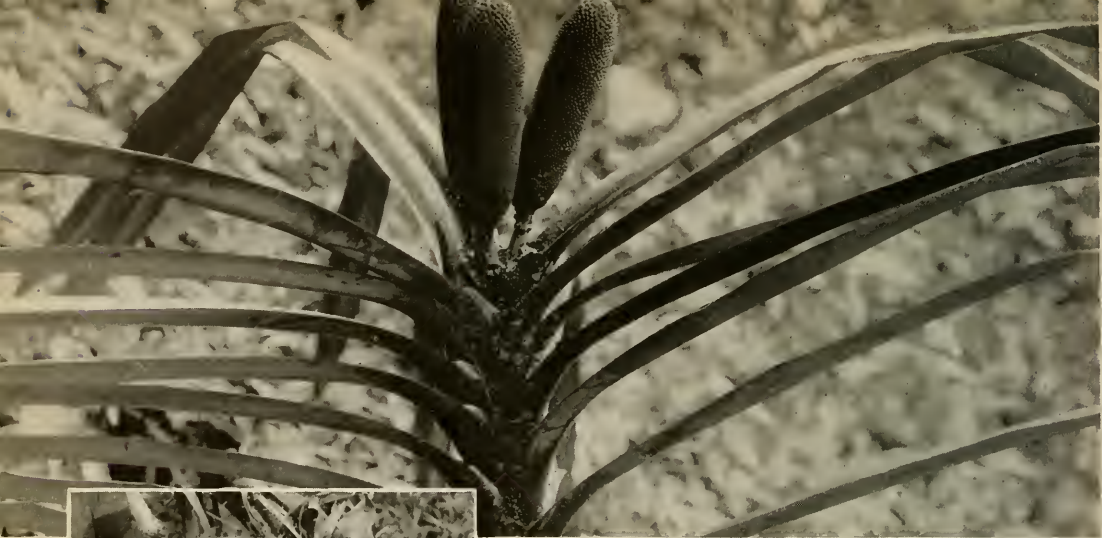
Below:—Mountain carriers leaving Urunu on the way back to the coast



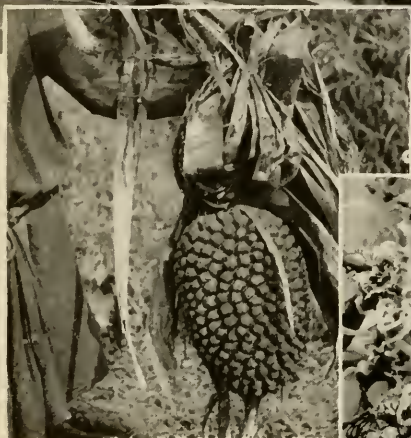
Left:—Coastal carriers crossing the Vanapa River by means of logs from rock to rock. These carriers, being coastal boys, showed great nervousness, to the amusement of the mountain carriers



The large photograph shows the expedition's Nimode Camp situated on Mt. Tafa eight days from the coast. Though the sun was shining when this picture was taken, normal conditions were quite different. Throughout the expedition's stay at this point, the weather was consistently rainy



Above:—The fruiting top of *Freycinetia*



Left:—Fruit of the *Pandanus*



Right:
A lowland orchid. Throughout Papua orchids are unusually abundant

Opposite page:—This lake near the summit of Mt. Tafa is held in great reverence by natives who claim that a devil lives in it, and that if any person should step into the water, he would disappear



Right:—Flowering branch of epiphytic rhododendron from Mt. Tafa

Below:—Flowers of rhododendron, photographed near Mafulu in the interior





Birds and Beasts



Above:—A lizard collected by the expedition in the mountains

Right:—A tree-climbing member of the kangaroo family restricted to New Guinea and Northern Queensland



Left:—One of the rare finds of the expedition. This is the first specimen with authentic locality so far reported from New Guinea. It is the Australian echidna or spiny anteater, differing considerably from its Papuan representative

Below:—Two young wallabies just taken from their mother's pouch





Above:—Kuni boys with
bird-of-paradise feathers
which they have brought
to the coast to trade

Right:—A young hornbill
not yet able to fly



Below:—A New Guinea
barn owl





A native coastal village
on the tidal Kikori River

Papuan Villages

Urunu boys with spears accom-
panying one of the expedition's
servants on the way to the coast



*Below:—*The coastal village of Orokolo, showing
one of the large dubus. The tall central door
is necessary to permit the Motuan dancers to
get out with their headdresses on





Hanuabada, the native quarter of Port Moresby. This is a most civilized village, possessing electric lights and homes equipped with tables and chairs

The dance platform with a dance in progress at Port Moresby



and Villagers

Urunu boys with spears and clubs, with the expedition's "skinning boy"



Dress Parade in Papua



Manu Manu dancer. The huge headdress is beautifully decorated with feathers, many of which are plumes from birds-of-paradise

Two dancers in full dress. They both wear long necklaces made of dogs' teeth, and carry drums, the heads of which are lizard or snake skin



Below:—
Mambari
dancer





Men of the Motu Tribe



Married women of the Roro Tribe



Koari dancers. This tribe lives in the interior not far from Port Moresby



Left:—Man of the Roro Tribe attending to his toilet by the wayside

Papua is that portion of the great island of New Guinea that lies to the east of the Dutch territory and to the south of the mandated territory of New Guinea. Port Moresby is the seat of the central government, and it is there that most visitors land. The natives of the territory have a great love of personal finery, especially on the occasions of their numerous dances. Brightly colored bird plumes, dyed palm fibers, carved shells and bone, and other ornaments are widely and effectively used

Jade, Amber, and Ivory

by

Herbert P. Whitlock

Curator of Minerals and Gems,
American Museum

26 Photographs

by the American Museum

Staff Photographers

AMONG the court officials who attended the Chinese emperors of the Chou dynasty (B.C. 1122-255) there was, it is said, a steward of the treasury whose task it was to attend to the preservation of the Hall of the Ancestor of the Imperial House, in which were kept all the precious objects handed down from generation to generation. This stewardship of the treasury, however, has long since been abolished. Even the latest dynasty of Chinese emperors has passed away and with it much of the tradition and romance that are always attached to what is old and what is regal. Yet, although there is no longer an imperial treasury in Peiping, there has been created during the past six months, in the American Museum in New York, a veritable "Hall of Ancestors," a treasure house in which are gathered the beautiful and precious objects representative of Chinese and Japanese culture brought together through the life work of a man whose knowledge and taste in these matters rendered him an authority of high standing.

This new acquisition of the American Museum is the collection of the late Dr. I. Wyman Drummond, which came to the Museum through the gift of his sister, Mrs. Katherine W. D. Herbert. In reality it is not merely a collection. Instead, it is a group of collections, each correlated with and supplementing the others; and with so keen an appreciation and such ripened knowledge have these units been chosen, that it seems

Precious and beautiful carvings of the Drummond Collection depicting not only the art, but also the ancient myths and legends of China and Japan

as though the touch of beauty passing from hard, cold jade to glowing amber and vitalized ivory, carries with it all the wealth of tradition and symbolism of the two great oriental races.

In the matter of jade alone the Drummond Collection, which is now the Drummond Memorial, is a rich and well balanced series, representative of all periods, and covering a cultural range of more than thirty centuries. Exceptional indeed is the splendid group of ancient jade ceremonial weapons which has no counterpart in other museums of the world. By far the most important piece in the series of carved jade, however, is the superb composite piece of white jade that constituted the gift to the Emperor Kien lung by the officials of his court upon the event of his fiftieth birthday.

In solving the problem of the display of the Drummond Memorial in the round tower room at the southwest corner of the fourth floor of the American Museum, this famous piece of jade has been made the center of the installation. From it, like the spokes of a wheel, radiate the eight upright cases, some of which are equipped with glass shelves, while others are treated in panel fashion.

The left half of the room is devoted to jade arranged by periods, and the right half is given over to amber, ivory, lacquer, and bronze sword guards. Around the walls between the window spaces are ranged the cabinets which contain the units of the Drummond Collection as they were formerly displayed at Doctor Drummond's residence. With these latter cases care has been taken to retain the original arrangement, so that every piece occupies exactly the position with respect to its neighbors that it did in the



The ivory statuette of K'wan Yin of the Fish is characteristically Japanese both in conception and rendering. It immortalizes in ivory the story of the princely fisherman who set up a shrine to this goddess after her image had repeatedly appeared in his net, taking the place of the fish he sought

K'wan Yin of the Fish

Japanese Figures

Left:—A miniature carving in ivory of the celebrated Buddha of Kamakara sitting in eternal meditation. Behind the master spread the wonderful conventionalized flames symbolizing purification



Above:—An elaborately carved ivory figure of K'wan Yin, the Goddess of Mercy, holding a vase which is one of the traditional objects associated with her. The wealth of detail and marked realism of this Japanese figurine is in strong contrast with the formal conventionality that stamps the Chinese rendition of such a subject

Left:—A charming and elaborately wrought figure of Lan Ts'ai-Ho, the work of a Japanese ivory-carver. Lan Ts'ai-Ho was one of the Taoist immortals who wandered through the streets singing of the futility of earthly pleasures



Carved In Ivory

Right

Wang Mu, the Chinese Queen of the Fairies, attended by one of her jewel maidens, who holds a basket filled with the immortal peaches. A very charming little group in Japanese carved ivory

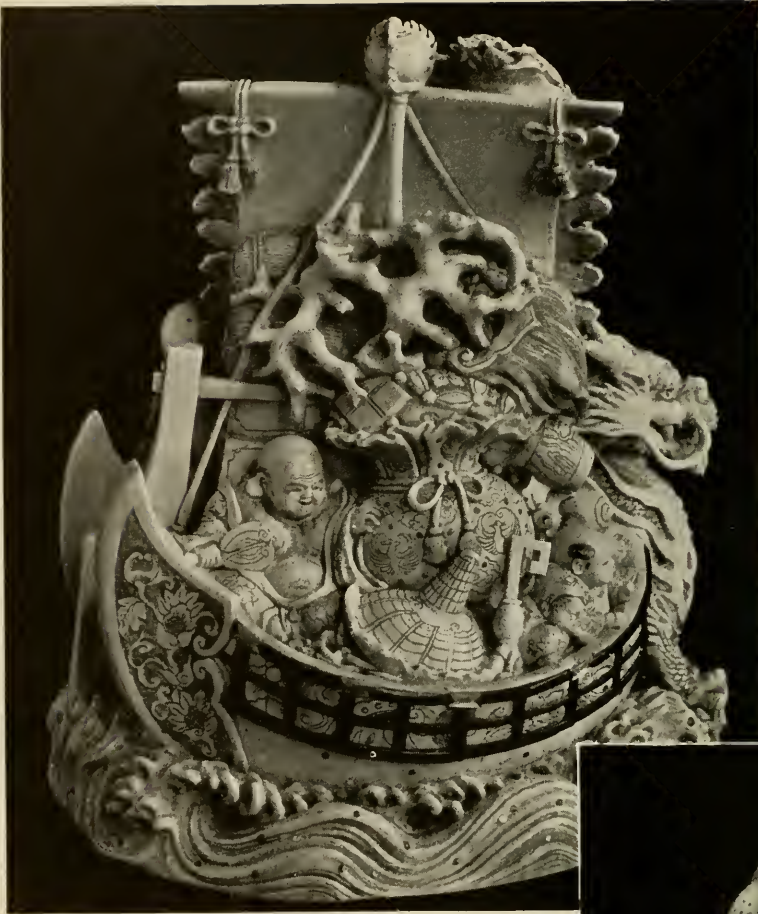


Left

The Three Heroes of Han, legendary Chinese warriors of the Han dynasty (200 B.C. to 250 A.D.). They are represented in this ivory carving as drinking *sake* in a kind of Japanese Valhalla

Chinese and Japanese Ivory

Left:—This intricate Japanese carving in ivory represents the Dragon Boat, laden with immortals and magical treasures. It is being guided to the Western Paradise by the crane, the messenger of the gods



Below:—The reverse of the group representing the Chinese Zodiac pictured at the left of the opposite page



Above:—Among the outlandish animals originating in Chinese mythology, one of the strangest is the Baku, the creature that feeds upon the bad dreams of mortals. This Baku is carved from ivory by a Japanese artist

Right:—The miniature figure of Ho Hsien-ku (only three inches high) is carved from ivory and dark wood. She is supposed to have lived in the Seventh Century, and, having attained immortality, became a fairy. In her hand she carries a fly whisk



Above:—This little masterpiece in ivory pictures a realistic group of the twelve creatures (the back of the group is shown on the opposite page) that represent the Twelve Terrestrial Branches, the Chinese zodiac. As seen they are the dragon, the rat, the cock, the monkey, the ox, the serpent, the goat, and the dog

The carving of a "puzzle ball," such as this one, is a feat of ivory carving performed only by Chinese artists. Carved from a single piece of ivory, this ball incloses eight others, each smaller than and separated from the next outer one



lifetime of this famous connoisseur, the charming taste and sense of color that have always characterized his displayed collection thus being retained.

Particularly is this the case with the series illustrating the various colors of jade of relatively modern date, which includes among others the rare lavender tint very much prized among collectors.

The magnificent suite of Burmese amber, which also speaks eloquently of Doctor Drummond's taste in color arrangement, has been conceded to be the finest assemblage of oriental amber in the world. Here ruby-red colors contrast with limpid honey-yellow and mottled orange in wonderful and intricate carvings.

Of the six wall cases that contain the varied and important collection of Chinese snuff bottles, one is filled with those fashioned almost exclusively of oriental amber.

JADE

Perhaps no one material other than jade can turn back so successfully the pages of time and permit us to read the record of a culture that was old when our own was struggling to emerge out of barbarism. Here, among these old jade objects, many of which have been buried for centuries, we find the beginnings of a philosophy, cosmic in its inception, that in China has outlasted dynasties.

Among the most ancient of the symbols carved in antique jade is the group of designs called the Twelve Ornaments. More than 2000 years B.C. the Emperor Shun, referring to these designs, said, "I wish to see the emblematic figures of the ancients embroidered in five colors to decorate the official robes." Only the Emperor had the right to wear the complete set of twelve emblems on his ceremonial robes. Nobles of the first rank were restricted from using the symbols of the highest order. With decreasing rank further restrictions in the display of the remaining nine ornaments defined five sets of official robes. In the Drummond Collection an ancient and beautifully carved jade piece,

representing the deity Earth, expressed by the Chinese as being square outside and round inside, represents on one of its faces these ancient Twelve Ornaments.

A very fine piece of white jade of the Kien lung period of renaissance in glyptic art is in the form of a "Scepter of Good Luck" (Joo-i scepter). On the long handle of this piece are carved in high relief the figures of the Eight Immortals, the half mythical, half historical personages so often represented in Taoist art. Each of these carries some characteristic object, such as the flute of Han Hsiang-tzu, whose marvelous tone caused flowers to grow and blossom instantly.

Singularly enough, there is, in the Drummond Collection, a Chinese flute carved from pure white jade, and while those of us who were privileged to hear M. Georges Barrère play upon it at the opening of the Drummond Hall, might need to stretch our imaginations a little in order to credit it with causing the spring flowers to bloom, it nevertheless has a remarkable tone, quite capable of producing exquisite music. Incidentally, it was made in 1488 in the Studio of the Eternal Spring. Many symbolic designs, have, through the reverence that all Chinese have for what is old and traditional, persisted throughout jade and amber carvings down to the present day. (See the author's article on "Jade" in *NATURAL HISTORY* for September-October, 1932.)

JAPANESE CARVINGS

In sharp contrast to the conventional treatment and traditional recurrence of designs in Chinese carving, is the realistic freedom that characterizes the work of Japanese carvers in ivory and wood, scores of examples of which are included in the Drummond Collection. Hampered by no such formalism as that which has been handed down through generations of Chinese lapidaries, the Japanese artists, working in ivory, produce graceful and impressive figures of the sages and immortals, charming and often grotesque statuettes,



*Above:—A general view of the
Drummond Hall*

*Circle:—A portrait head of the
late Doctor Drummond, modeled
by James Drummond Herbert*

*Below:—In the center stands the as-
semblage of jade pieces which was
presented to the Chinese emperor
Kien lung on his fiftieth birthday*



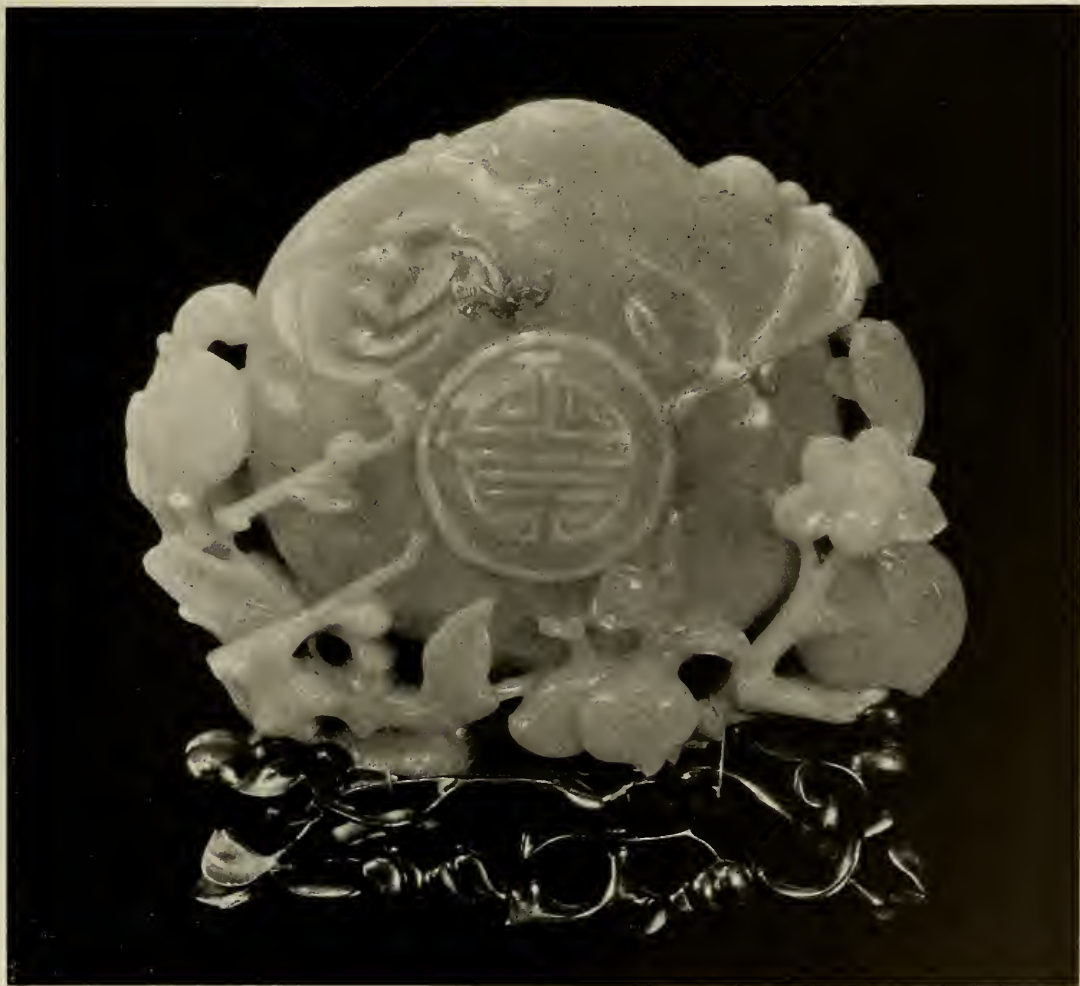


Jade
and
Amber

This white jade incense burner is a superb example of the open work carving that reached its height in Kien lung's time. Both the bowl and the cover were reduced to about the thickness of a piece of heavy cardboard before the intricate lacelike pattern was executed with hundreds of cleverly shaped holes

The dragons on this jade cup are of the form which developed in China in the Ming dynasty. The perfection in carving, however, shows the piece to be of later date, probably early Kien lung

Of a wonderful rich orange is this piece of Burmese amber carved to resemble a huge peach, to which is added the "long life" symbol, showing that it is a "Peach of Immortality." Two bats, signifying happiness, flutter above





An Emperor's Birthday Gift

A masterpiece of modern carving in white jade was selected for this gift to a famous emperor—Kien lung. The central piece has a loose button decorated with the *yang yin* (universal life symbol). Surrounding the central piece are twelve pieces fitted together, each of which is carved with a representation of one of the twelve creatures which in China correspond to the signs of the zodiac as used by Westerners

A very ancient jade image of the deity Earth carved with representations of the Twelve Ornaments. Reading from the top downward these are: The sun, the moon, the stars, mountains, dragon, pheasant, the cups, pond weed, fire, grain, the axe, and the symbol of distinction. The Twelve Ornaments are of great antiquity and signified authority and power



Highly conventionalized dragons as well as a bat meaning happiness mark this elaborately carved disk of white jade

Sword Guards

A magnificent gold dragon decorates this Japanese sword guard, and since this is a "dragon of the air" he is surrounded by conventional clouds



The subject pictured on this sword guard in bronze of various colors and in gold inlay is from the Japanese fairy tale of the sparrows who entertained their human friend in a manner singularly human, even for fairy-tale sparrows

The maker of this magnificent Japanese sword guard chose for his subject the fairy tale that recounts the adventures of Momotaro, who, with the aid of a dog, a monkey, and a pheasant, overcame the demons and took their treasure for ransom





A Traveling Shrine

This lacquered box is in reality a traveling shrine. The wooden interior displays a figure of Amitabha, the Buddha of Enlightenment, beautifully carved and gilded

A Crystal Snuff Bottle

Among the almost miraculous feats of dexterity practiced by Chinese artists is that of painting the inside surface of a glass or rock crystal snuff bottle. This delightful little painting was executed by passing a very minute brush through the neck of the bottle and reversing the strokes, somewhat in the manner of a "looking-glass" painting



and groups illustrating folk lore and legend dear to the hearts of Japanese boys and girls.

Among the ivory figures of appealing beauty from the Drummond Collection, is the "K'wan Yin of the Fish" in which the goddess is poised with great freedom of action upon the back of a huge carp. The legend that inspired this masterpiece relates how a banished Japanese prince, who was forced to earn his living by fishing, on one occasion found in his net no fish but instead a small image of the Goddess of Mercy. This he threw back into the sea only to find it again when he next cast his net. So he kept the image and with his own hands fashioned a shrine for it on a hill overlooking the sea, where the Goddess of the Fish was continually worshipped.

Another charming figurine to which a story is attached, is Hsi Wang Mu, the Chinese Queen of the Fairies, whose legend, like many other Taoist myths, was brought into Japan from China. It is said that the palace of Wang Mu is in the Kuen-lun Mountains, where she guards the Tree of Immortal Peaches that grows beside the Lake of Gems, whose fruit ripens upon her birthday, every 3000 years. Here gather to the Feast of Peaches all the immortals to renew their immortality by eating the celestial fruit.

CARVING IN IVORY

A small but extremely intricate ivory carving shows the Dragon Boat laden with sages and immortals and freighted with the fabulous treasures of Takaramono, which include the hat of invisibility, the purse whose wealth never fails, not to mention many other remarkable things. Above flies the crane, the messenger of the gods guiding the vessel to the Western Paradise. With such wealth of detail are all of these ivory pieces wrought that such matters as necklaces and headdresses are rendered with the greatest fidelity. In fact, whole costumes might be copied to the last clasp and fold from these authentic sources. And such costumes! It would seem as though the

devine K'wan Yin, and Lan Ts' ai-Ho, the immortal flower girl, were especially created to grace costume balls and pageants.

SWORD GUARDS

Much as the Japanese carver in ivory loved to draw his subjects from the legends and myths of Japan, he was probably no match in this respect for his brother craftsman whose art consisted in fashioning sword guards from iron, bronze, and other alloys, some of which are not used outside of Japan. These were inlaid in gold and silver with great skill and artistry. A large and very handsome example from the Drummond Collection depicts an incident from the fairy tale of Monotaro, the boy who was found inside a peach, and who grew to be a sort of Japanese "Jack the Giant Killer." Accompanied by a dog, a monkey, and a pheasant, he invaded the island of the devils and, having overcome them in battle, returned to his astonished foster parents with all of their fabulous treasure.

Another beautifully inlaid sword guard illustrates the fairy tale of "The Tongue-cut Sparrow" who, after sumptuously entertaining his benefactors with food and *sake*, rewarded them for their charitable deeds with a basket filled with treasure. Needless to say the spirited designs which picture these folk tales are wrought by master artists whose names inscribed on little gold inlaid plates actually add to the attractiveness of their designs.

In order to describe in detail the hundreds of works of art that make up this extraordinary collection, one would almost require the magic aid of the gods and devils that are so generously portrayed among them. Nor, even then, could words picture these beautiful objects satisfactorily. Color, form, patina, subject matter—all require first-hand visual examination, before their beauty and their rarity can be made manifest.

They are, however, now on permanent display, and are ready, always, to offer their beauty to any who care to see.

Autumn Flowers

How to plan a garden
that will continue
to bloom until frost

by

T. H. Everett

Horticulturist,
The New York
Botanical Garden

With 20 Photographs
by The New York
Botanical Garden



McFarland Photograph

PLANNING for fall effects in the flower garden rarely receives the same amount of consideration as that given to the spring and summer plantings, and in consequence the garden is apt to be less of a success in autumn than earlier in the year. Yet at this season a colorful display is often more desirable than during July and August when the vacation season takes so many people away from home. By the exercise of a little forethought, however, and the proper selection of material, very lovely effects can be obtained.

The time to start planning next year's garden is now. Stroll through your own garden and through the gardens of your neighbors. Visit the New York Botanical Garden and other institutions where collections of growing plants may be seen. Avail yourself of the opportunity to see large estate gardens which are opened to the public in the aid of charities from time to time, and

do not omit visits to a number of nurseries. Take your notebook with you and make careful entries of those plants which especially appeal to you as worth growing, and which you would like to have. Write down their varietal names, height, color, date of blooming, and other pertinent points. Most garden plants grow best in a sunny, open position, or in light shade, and in a rich, loamy, well-drained soil, but if you observe any which are thriving in heavy shade, or in a poor, sandy soil, or a very wet position, record this in your notebook, for it is likely that the same plant will do well under similar conditions in your own garden, and it is very easy to forget such details before planting time comes around unless they are committed to paper.

In particular write down the names of varieties which associate together happily, for, while a few people have a good color sense and a good color memory, the majority

Colorful

Left:—
The Floyd Gibbons is
colored a bright copper



*Above:—*The small flowers of the
Teddy Johnson are soft rose-pink

*Left:—*The Everest is a
new and striking form

*Below:—*The Sagamore is amber-
gold, with orange-buff shading



Dahlias

*Right:—The
Viola Fernschild
is delicate pink*



*Above:—The Jane Cowl
is bronzy-buff and salmon*

*Right:—This bright red giant
is the prize winner Satan*

*Below:—The Alice Marie
is pink and creamy ivory*



cannot safely trust to these and must perforce resort to notes. By cutting a few flowers and holding them against other varieties in bloom at the same time, pleasing combinations can be worked out, and sometimes rather surprising results are obtained in this way. It must be remembered, however, that color is not the only factor determining whether flowers will associate together pleasingly—form and texture as well as character of foliage play important parts, and the effect of these can best be seen by holding distinct varieties next to each other in the manner described.

PROPORTION IN COLOR

Another point which seldom receives the consideration it deserves in planning garden color schemes is the effect of the actual numerical proportion of the various colors associated together, yet this can be extremely important, especially in the more daring arrangements. A hue which, when introduced with proper restraint, enhances the whole effect of the garden, may become horribly insistent and overpowering if overdone.

Having acquired as much reliable data as possible concerning the plants it is desired to grow for fall effect, it becomes important for one to plan on paper just where they are to be planted, and to coördinate their use with the flowers that bloom at other seasons. This very properly may be regarded as winter work, and will prove one of the most delightful phases of fireside gardening. In a garden of any considerable extent a border planted entirely with a variety of autumn-blooming subjects can be a very splendid feature, or borders or beds can be devoted to distinct kinds of plants, or even to individual varieties with excellent effect. Limitations of space usually prevent such luxuries in the small garden where the mixed border must of necessity provide a home for a variety of plants which bloom from early spring until late fall.

Whether the garden be large or small, certain fundamental requirements in the

way of soil preparation must be met if fine flowers are to be produced. This work should not be postponed until spring, but rather should receive attention just so soon as a killing frost writes "finis" to the present flower garden season. It has been said with much truth that the cups and medals awarded at the autumn flower shows are really won the year previous when the soil is turned and manured. Many amateurs neglect this phase of cultivation and in consequence the quality of their produce suffers. Do not imagine that you can get praiseworthy results by merely scratching over the top few inches of soil, sprinkling a little fertilizer about, and grubbing out a small hole at planting time. Invest in a good spade or digging fork and turn over the earth where plants are to be placed to a depth of at least ten inches. Incorporate with the soil at the same time a generous supply of partly rotted manure, or, if this is unobtainable, substitute humus, leaf-mold, or any decayed vegetable matter from the compost heap. No amount of chemical fertilizer can possibly take the place of organic matter, although such fertilizers can be used with good effect in spring and through the growing season to supplement the more bulky manures turned under in the fall or early winter months. When digging at this time of the year, leave the surface in a rough condition so that the frost and other weathering agencies can effect their maximum benefits.

SPRING PREPARATIONS

By spring the soil should be in a wonderfully friable state, sweet and kindly to the roots of plants. A light orking over with the addition of a little bone meal or other slow-acting fertilizer will put it in planting condition. If it is thought that liming is desirable—and the majority of fall blooming plants do best in a soil which is limed every third or fourth year—a dressing of ground limestone may be scratched into the surface before planting. Remember that lime is soluble in rainwater and gradually leaches



McFarland Photograph

An Autumn Garden

Sweet alyssum blooms late into the fall, seeming to increase its fragrance with the advancing season. Above the steps, tall Japanese anemones flower as profusely as their tiny American cousins are likely to do months before in early spring



Golden, red and bronze, pale yellow, pink and white, they play an important part in supplanting the autumn leaves and the flowers of summer

Chrysanthemums Defy the Frost

Ermalinda blushes with the softer tints of pink

Chrysanthemum nipponicum
graces any autumn garden





Above:—Romona Warren
makes a fine bouquet



Above:—Crista, one of the
smallest of chrysanthemums



Left:—Julia Quinland, an-
other favorite for picking

Below:—*Chrysanthemum arcticum*
blooms in rock gardens
after most other flowers are gone



downward, therefore much of its benefit is lost if it is buried deeply in the soil.

With the soil in good condition and the planting plans prepared, the next problem is that of securing the plants and seeds required. Some of these may be obtained from friends by gift or exchange, but the seeds and oftentimes many of the plants usually will be purchased. The only advice worth offering here is to deal with nurserymen and seedsmen of repute and pay a fair price. So-called bargains are apt to prove expensive in the long run. After all, the initial cost of a few seeds or plants is but a small item in the garden budget—certainly too small an amount to risk disappointment by undue saving. The time of planting will of course vary with the type of plant. The hardy perennials should be placed in the ground at the first favorable opportunity the spring offers, selecting always a time for this work when the soil is in a pleasant, crumbly condition, rather than being wet and sticky. Hardy annuals for fall flowering should in most cases be sown during the early summer, while half-hardy annuals will be most satisfactory if sown in spring and planted out as soon as warm and settled weather seems assured.

FOUR GROUPS OF FALL FLOWERS

Fall flowers may be classed in four main groups. First we have those which are normally and characteristically fall-bloomers as the dahlias, asters, and chrysanthemums. Most of these are perennials, although cosmos and a few other subjects either are annuals or are treated as such by the gardener. The second group consists of true annuals together with certain tender bulbs, and while these are not primarily autumn flowers, a number may be had in bloom at this season by selecting appropriate sowing and planting dates. Included in the third group is a large number of both perennials and annuals (using the term annuals in the garden sense to include all those plants which are usually raised from seed to bloom the first year and are afterward discarded).

These have their main season of bloom earlier in the summer, and during the hottest weather remain more or less dormant so far as flower production goes, but under the influence of the soft rains and genial sunshine of September they break into a second flowering which is always delightful.

FLOWERS THAT BLOOM TWICE

Delphiniums, roses, and the sweet-scented *Daphne cneorum* come to mind as perennial representatives of this group, while hybrid verbenas, early sown sweet alyssum, and California poppies serve as examples of the annuals belonging here. It is interesting to note that among the perennial plants which have this decided second season of bloom, the later flowers frequently assume a more intense color than do those produced earlier in the year. The fourth and last group comprises a number of plants which bloom continuously throughout the summer and fall months, as heliotropes, lantanas, cannas, geraniums, and begonias.

The dahlia is surely queen of autumn flowers and, judging by its well-deserved popularity, will continue to reign in this proud position for many years to come. Every year many thousands of people visit the New York Botanical Garden especially to view the dahlia collection there, which comprises more than four hundred distinct varieties and is a blaze of color from August until the advent of severe frost. Dahlias offer but few difficulties to the cultivator, and as their growing season occupies only about four months, the period during which they require skilled attention is correspondingly brief. They are raised either from divisions of old roots planted out of doors about the first of June, or from seeds or cuttings planted in spring in the greenhouse and grown on into what are termed green plants. These green plants may be set out in the open ground during the first two weeks of June. When making divisions, care must be taken that at least one "eye" or bud is left with each. At planting time, first drive a stout stake where each plant is to be

placed—allowing three or four feet between the plants—and then set the root or plant close to the stake. Subsequent care consists of hoeing, watering, tying, and spraying. Disbudding is necessary to prevent overcrowding of the growths and to encourage the production of large flowers.

CHRYSANTHEMUMS

Perhaps no flower is more characteristic of late fall than the chrysanthemum, and the hardy varieties are certainly worthy of a place in any garden. They come in a wide range of colors, including warm yellows, oranges, bronzes, and reds, as well as in whites and pinks, and delight us with bloom long after all other garden flowers are past. These chrysanthemums are of course quite perennial, but the best results are obtained if the old plants are lifted, and divided and replanted each spring. Each division should consist of a single shoot two or three inches long with a few roots attached. Plant the divisions about a foot apart in well-prepared ground and, after they are established, pinch out the tops to induce a bushy habit. This pinching should be repeated two or three times during the early part of the season. Frequent surface cultivation, staking, and tying must receive attention, and a watchful eye should be kept for pests. Hardy chrysanthemums are of several distinct types, as large-flowered, singles, anemones, pom-poms, and baby pom-poms. The smaller-flowered kinds will not require disbudding, but the largest blooms can be obtained only by giving some attention to this matter. Disbudding of chrysanthemums consists of the removal of all but the terminal bud on each shoot so that the energies of the plant are concentrated in the development of a few blooms rather than the large number which normally would be produced.

Familiarity breeds contempt, and perhaps this explains why, until comparatively recently, we have been inclined to neglect the fall asters in our gardens, although everywhere the fields and hillsides are purple with the parent species of many of

the finest varieties. Most of these improved varieties have been raised in Europe. In England particularly they are exceedingly popular and are known as Michaelmas daisies. Hardy asters thrive in any average soil in an open position. Old plants should be lifted and divided every second or third year. If especially fine flowers are desired, it pays to thin out the growths to some extent in early spring, so that those left have sufficient room to develop to fullest advantage. A very distinct aster known as "mauve cushion" is valuable for the front of the border or for inclusion in a large rock garden. This variety makes a dense, flat-topped, bushy plant, eighteen inches or two feet high, and bears a profusion of delicate lavender flowers late in the season.

Closely related to the asters and requiring identical treatment are two species of *Boltonia* (*B. asteroides* and *B. lat squama*). These grow from six to eight feet high and are admirable for planting toward the rear of the border.

ANEMONES AND LILIES

Where a moist yet well drained soil is available and some light shade can be provided during the hottest part of the day, the Japanese anemones may be expected to do well. They come in a number of varieties ranging in color from pure white to deepest pink, and may be had in single, semi-double, and double forms. A dwarf-growing variety of this species is known as *Anemone hupehensis* and flowers a little earlier than the other varieties. Anemones of this japonica group only give of their best when well established. They resent disturbance at the roots and so should not be transplanted unless absolutely necessary.

At least two lilies for supplying fall bloom can be readily accommodated in a cool, well-drained border, where the lower parts of the stems are shaded by the foliage of herbaceous plants or by low-growing shrubs. The most satisfactory of these is *Lilium speciosum* which is available in a number of distinct color forms, ranging from the white-flowered

Autumn

Left:—Showy stonecrop
(*Sedum spectabile*) prefers
to have a sunny bed



Brown Bros.

Gladioli, if planted late,
will continue to bloom well
into the autumn

Cannas are now avail-
able in orange, rose, and
salmon color, as well
as many shades of red
and yellow, some with
handsomely bronzed
foliage



Favorites

Right:—Japanese anemones
in September are graceful
reminders of spring



Scabiosa, Buddleia, and
Cimicifuga comprise this
attractive autumn bouquet
in blue and white



New England asters
make showy garden
flowers for autumn. Im-
proved varieties have
been developed abroad

variety known as album to the deep red variety Melpomene. *Lilium auratum platyphyllum* is the finest form of the golden-rayed lily of Japan. This blooms rather later than the other varieties of this magnificent species, bearing flowers which frequently measure as much as twelve inches in diameter. They are white with a yellow band down the center of each segment and lightly marked with red spots. Unfortunately, all the *Lilium auratum* varieties are uncertain in cultivation and are very apt to become diseased, dying after a year or two in the garden. Rogueing out every plant which shows any evidence of the dread mosaic disease should be rigidly practiced, for no cure is known for this condition. Both of the lilies mentioned produce stem roots, therefore the bulbs should be planted so that their tops are at least twice the depth of the bulb below the surface. Fall is preferred to spring as a planting season for lilies. Like the Japanese anemones, they object to frequent transplanting, hence should be allowed to remain undisturbed so long as they are doing well. A light soil well enriched with leaf mold or peat suits these lilies best.

OUTSTANDING LATE FLOWERING PERENNIALS

Without attempting to list or catalog all the late-flowering perennials, the following come to mind as I write, and suggest themselves as worthy of consideration. *Eupatorium ccelestinum*, *Liatris* in variety, *Physostegia virginica*, *Aconitum* in variety, *Cimicifuga simplex*, *Helenium autumnale* varieties Riverton Gem and Riverton Beauty, *Salvia azurea* Pitcheri, *Kniphofias*, *Sedum Sieboldii*, *Lysimachia clethroides*, *Lobelia cardinalis*, *Lobelia syphilitica*, *Chrysanthemum arcticum*, *Chrysanthemum Koreanum* and its hybrids, *Sternbergia lutea*, Autumn-flowering *Crocus*, *Ceratostigma plumbaginoides*, and *Polygonum affine*. The last five mentioned are particularly well adapted for rock gardens.

Many hardy annuals if sown in late May or early June will give a good display of

bloom in September. The China aster is typical of this group, and a point in favor of late sowing in this particular case is that the flowers are not destroyed by the aster beetle which often works havoc with earlier plantings. Seeds sown in May or early June should be covered more deeply than those sown in April. An especially important point to remember is that the drills in which the seeds are scattered should be well soaked with water a few hours before actual sowing.

GLADIOLI AND DELPHINIUMS

Plantings of gladioli made up to the end of June will result in elegant material for cuttings and for the embellishment of the garden during September. Particularly are the *primulinus* hybrids valuable for this purpose.

Among plants which have a second season of bloom during the fall, one of the most satisfactory is the hybrid delphinium. To obtain the best results the plants should be cut back somewhat after their first flowering and the ground should be loosened up and mulched with some old rotted manure. Good spikes of delphiniums may also be obtained late in the year from plants raised from seed sown in the greenhouse in January or February. The young plants are grown on under glass until late April when they are planted out of doors about eighteen inches apart.

Thus by selecting the proper flowers and planting them in the right season, those who have missed—or have not had enough—of the beauty of midsummer gardens still can enjoy a splendid display of flowers when vacations are over.

To produce fine blooms for any season one must know plants and the conditions under which they thrive. One might as well try to learn to swim as learn to garden from books alone. I cannot overemphasize the desirability—indeed the necessity—of becoming intimately acquainted with the gardens of others as well as getting out in one's own garden and grubbing in the soil.

The Crafts of Pre-Columbian Central America

The fourth of a series of six articles
on Central American native art

by

George C. Vaillant

Associate Curator of
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American Museum

MANY of the crafts of ancient Central America have persisted to the present day in spite of the transformations which the Spanish Colonial Empire and modern industry have wrought on the native civilizations. The major arts of the ancient peoples now exist more as an heirloom than a useful heritage. The modern artists from the Central American republics have recently utilized aboriginal themes, but between them and their source material stretch four hundred years of European artistic inspiration. In the crafts, however, there are connections, oftentimes tenuous to be sure, with the aboriginal industries. Sometimes only the technique survives, and the subject matter is completely Spanish Colonial or modern Republican. None the less, it is in the crafts that we feel most strongly the influence of the Indian past.

The applied arts of the ancient civilizations embodied many of those characteristics noted in architecture, sculpture, and painting. The same religious purpose that dominated the stone carving not only extended to ceremonial dress and temple paraphernalia, but even penetrated into secular possessions. Thus the elaborate decorative expression of ceremonial values influenced the craftsman as much as it did the creator of artistic masterpieces. Such a result, however, is natural, for there are no sharply

drawn distinctions between the two spheres of action. Skillful workers were drafted to enhance the religious ceremonial, which gave the chief outlet for æsthetic expression. Wealth and social position, which make possible the private possession of fine things, were inextricably combined with the gradations of the religious hierarchy.

Surviving examples of these ancient arts must often take the place of selected masterpieces, for most of the perishable material has disappeared, owing to natural decay or to the willful destruction of war and conquest. Often the written descriptions of the Spanish Conquerors or the crabbed drawings in the native documents offer the sole testimony of remarkable craftsmanship in ancient Central America. Descriptions of the jewelry and pottery we shall reserve for succeeding articles, since much of this material is wrought of imperishable substances and has survived in far greater quantities than examples of weaving, feather work, wood carving, and the like.

Weaving was an important art in Central America, but few examples have resisted decay. To determine its degree of excellence we must rely on knowledge derived from other areas, where arid climates have preserved textiles and other perishable materials. The Basket Makers of the Southwestern United States, the earliest agriculturists discovered in that region, developed great skill in weaving cloths, sandals, and baskets, before they learned how to make pottery. Thus we can postulate with some confidence that weaving in the New World was well advanced on a very

Costumes

The richness of Aztec costume deeply impressed the Spanish Conquistadores, but the contemporary drawings do scant justice to the originals. These illustrations by Keith Henderson for Prescott's *Conquest of Mexico* published by Henry Holt in 1922, recapture the splendor of the Aztec scene, thanks to the artist's study of native source material



This drawing of the Aztec ambassadors to Cortes shows the dress of high officials. Note the elaborate coiffure and the ornamental mantles. The feather fans further add to the splendor of the costumes



This procession of warriors shows the imagination that governed gala dress. As this is a peace-time occasion, they are carrying flowers and standards in the place of weapons. Cotton, skins, feathers, and paper were utilized in composing these outfits

Women's dress, as exemplified by these Totonac girls, was relatively simple, yet with a little tailoring these lovely fabrics would not be out of place as sports costumes today



early cultural horizon. At the other extreme we find the magnificent textile art of ancient Peru, miraculously available to posterity, because the arid climate preserved thousands of burials, each enveloped in several lovely fabrics. That distinguished authority, Mr. M. D. C. Crawford, said of Peruvian weaving, "No single people we know ever invented and perfected so many forms of textiles," and again, "In tapestry Peru reached its highest textile development. The harmony of color, the beauty and the fastness of the dyes, and the perfection of spinning and weaving, place these fabrics in a class by themselves, not only as compared to other textiles of this land, but as regards those of any other people."

Although we have scant means of judging the relative merits of the fabrics of Central America and Peru on the basis of weaving technique, we can compare their designs. The Mexican tribute rolls list mantles in many patterns, and on the great Maya sculptures we see evidence of the most elaborately decorated vestments. These designs are by no means inferior to those adorning the textiles of Peru. If the actual weaving processes were less developed in Central America than in Peru, the decorative aspects must have been very nearly equal.

ENRICHMENT OF FABRICS

The greatest development of the Central American textile art lay in dress. Although the quality of the garments depended on the station of the wearer, the basic costume was the same for all classes. Men wore a breech clout and mantle, knotted at the neck, both made of cotton or maguey fiber. Women usually were clothed in a skirt and a long blouse, the *huipil* which is still worn in parts of Central America. Such costumes could be varied or enriched by the quality of the fabric or by its decoration of brocade, openwork patterns, or embroidery. Additional means of enriching the fabrics were provided by tie-dyeing, batik, and complete dyeing in colors made of various vegetable and animal substances like logwood or

cochineal. Clay stamps were used to print designs either on the fabrics or on the skins of the wearers.

The accessories of dress called into play much cunning craftsmanship, since for ceremonial occasions and warfare dazzling costume was demanded. A conspicuous element of ceremonial dress involved the use of feathers. Sometimes the feathers were attached to a loosely woven fabric in such a way that they made an actual cloth, with the designs worked out in various colors. The plumage of different birds was also employed as a mosaic adorning shields and helmets. Long plumes of tropical birds furnished crests on headgear or formed part of the standards which picked warriors wore on their backs to distinguish various clan and tribal units.

FEATHERWORK AND WOOD CARVING

Today the finer types of weaving and featherwork have disappeared with the destruction of the ancient religion, and the adoption of European costumes for gala occasions. An attractive embroidery still lingers on the Highlands of Guatemala, although many European motives have entered the designs. The featherwork, too, has almost ceased to exist, but, during the Colonial and early Republican period in Mexico, a sort of landscape painting in feather inlay survived.

Wood carving, like weaving, would be difficult to appraise, had not a number of examples found their way to Europe as trophies of the Conquest. Other specimens have either been guarded as heirlooms, or discovered by chance in dry caves. Prof. M. H. Saville, in his *Wood Carvers' Art in Ancient Mexico*, has gathered together all the available information on this art. The most intricate work is represented on several atlats or throwing sticks, which must have been reserved for state occasions. The same mastery of design which distinguishes the major works of art characterizes this carving. Wooden drums show equal artistic ability and the human and animal forms of

Turquoise mosaic mirror, Chichen Itza, Yucatan. The reflecting surface was probably made of a number of fragments of iron pyrites laid against the sandstone center. The elaborateness of the setting together with its discovery beneath an altar indicates that its use was ritualistic. After Morris, Charlott and Morris, 1931



Right:—Obsidian mirror with gilded wooden frame Mexico. This exceedingly rare specimen was purchased in Europe and may well have been among the presents sent to Charles V by Cortes



Lacquer tray. These gay utensils were a characteristic product of Mexican Indians during the Colonial period, and in recent years their manufacture has been revived in various villages in western Mexico. It is probable that their origin is Pre-Columbian

Pages From a

The Codex Florentino consists of several hundred paintings by Aztec artists to illustrate Father Sahagun's great work on the Aztec civilization. The pictures shown here give an idea of the complexity of the civilization. Besides the divisions expressed by our nursery rhyme, "Rich man, poor man,—" there was a great variety of other trades and professions, some of which



Rich Man



Poor Man



Gold Worker



Beggar Man



Thief



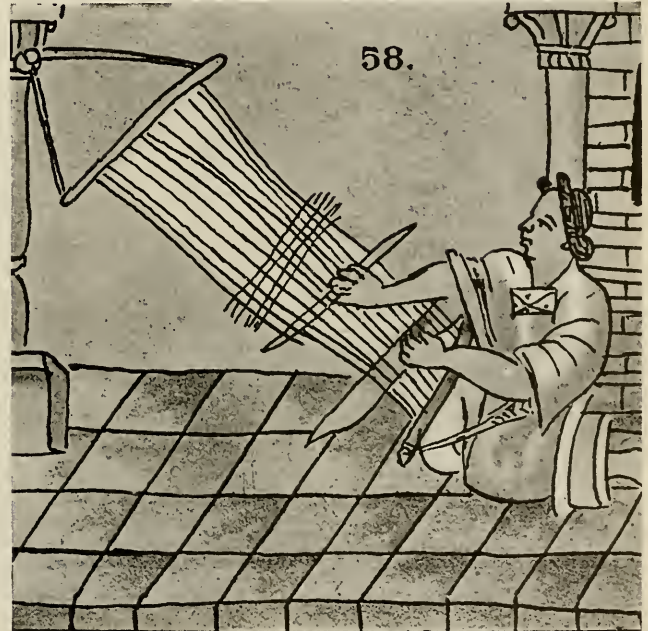
Feather Worker



Soldiers

Mexican Album

are shown at the bottom of these pages. Since the illustrations were intended for secular consumption, naïve vivacity (see, "Bathers") replaces the usual ritualistic formality. Compare these drawings with those of Keith Henderson on pages 486-7, to see how faithfully that artist caught the native spirit, and to guide the eye in perceiving the subject matter which is depicted in this group



several belong properly to the realm of sculpture. The construction of one type, the *teponaztli*, required considerable ability, for the sounding board consisted of two tongues of wood which were partly freed from the hollowed block of the drum and gave different notes. Although the tone of the drums varied considerably, the interval between the notes of each was always the same.

MOSAIC WORK

Masks of wood for religious purposes were frequently made, since the gods were impersonated in a number of ceremonies. Warfare, too, created a function for the wood carver in providing helmets which frequently took the form of animal heads. Yet such work was really the base for another distinctive Mexican craft, mosaic work, for knowledge of which we are again indebted to the erudition of Professor Saville. Fragments of turquoise, jade, obsidian, and shell were inlaid with consummate skill, and this art was a favorite method of embellishing a multitude of implements and jewelry. One of the most extraordinary examples of the craft is a shield in the Museum of the American Indian, where a scene in low relief is carried out in turquoise mosaic. The temples at Mitla show an adaptation of this mosaic technique in the creation of decorative friezes. Today, however, little or nothing survives of this industry.

A craft much more widely practiced was the cutting of shell. The demand for this easily manufactured substance was enormous. Few indeed were the New World peoples, however primitive and however distant from the coast, who did not barter for their quota. Shell most frequently was made into beads or pendants, and perhaps because of its almost universal use, seldom received the attention of the more skillful craftsmen. Yet conch shells were sometimes ground and carved into handsome trumpets, while some were covered with plaster and painted with ritualistic designs. A few engraved gorgets show how readily this material responded to a skilled craftsman, but such ornaments

are rare. Evidence exists that the carapaces of turtles and armadillos were also worked in ancient times. Some very beautiful objects are made of tortoise shell, today, but it is problematical whether this can be called a legitimate survival, or is of European introduction. Far to the south, in Panama, there occur splendid bone carvings that are reminiscent of major sculptures. Mention should also be made of carved whale teeth in the same region, and carved jaguar fangs in the Maya country, a type of work which showed considerable ingenuity in adapting the design to the natural form.

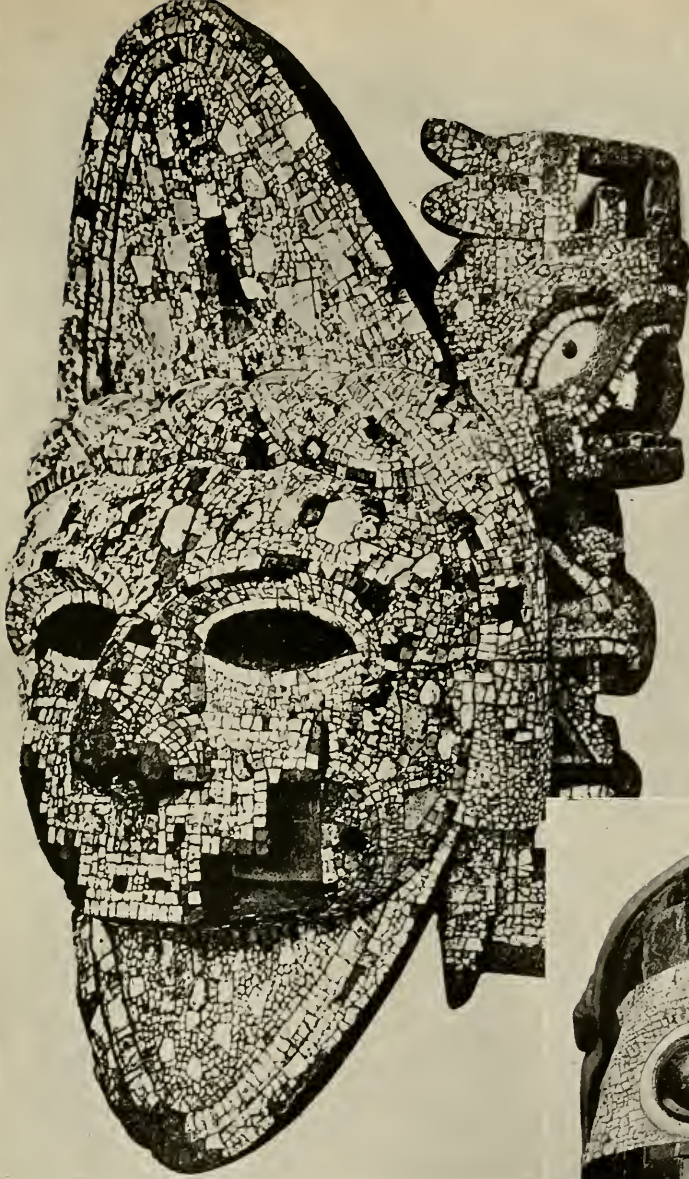
Horn and bone were substances perhaps too work-a-day for the highly skilled artisan. Needles, awls, flakers for stone tools, and many other household implements were made of bone, but seldom does one find a beautifully worked example. The most notable exceptions are the jaguar bones from the priestly tomb at Monte Alban. These were split and polished, and on their convex surfaces inscriptions of a ceremonial character were chased, with a minute precision worthy of the Japanese. The backgrounds of these patterns were picked out in turquoise mosaic. Engraved human femora, sometimes ornamented in mosaic, are grim reminders of the exigencies of Nahuatl religion.

STONE ARTIFACTS

Work in stone we have considered in respect to architecture and sculpture, and shall describe again in connection with jewelry. Yet to manufacture the ordinary implements of everyday life required a consummate mastery of an obdurate material. To detach in a single effort the thin blades of obsidian used as razors and scalpels for ceremonial blood letting necessitated as skillful a coördination of strength and skill as did the patient flaking of the great leaf-shaped sacrificial knives. Some of the axes ground from hard stones like jade and serpentine are aesthetically satisfying in their useful symmetry. This same pride in craftsmanship, which was not unlike that of a medieval smith, seems to have dominated even

Mosaic

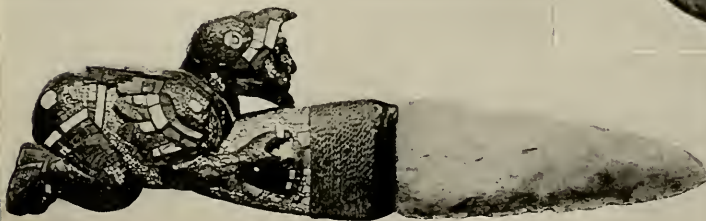
Mosaic working was one of the most elegant of Central American crafts, and color reproductions alone can give its true value. The wooden mask (taken like the two other illustrations on this page from Saville, 1922) was purchased from Cosimo de Medici for the Prehistoric and Ethnographic Museum in Rome, for two and one half francs. It must have been part of the loot from the conquest



Right:—This mosaic has as its matrix a human skull cut away in back to form a mask. It is one of the treasures of the British Museum. The lighter bands are turquoise and the darker, lignite



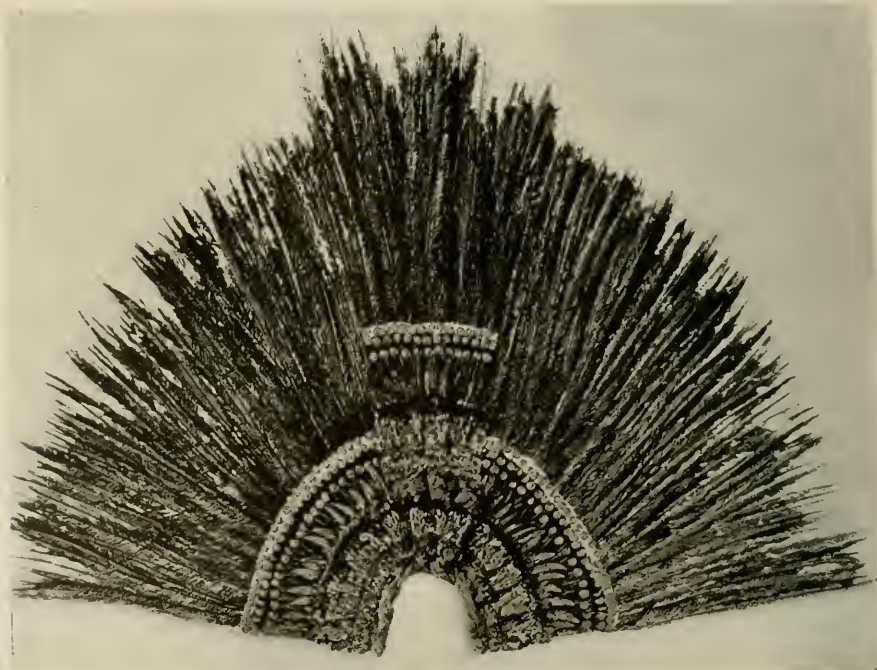
Left:—This sacrificial knife in the British Museum is a little more than a foot long. Turquoise, malachite, and variously colored shells compose the mosaic work which depicts an Eagle Knight





Featherwork is so extremely perishable that almost no Pre-Columbian examples survive. Under Spanish colonial influence, a sort of genre painting in feathers was developed which continued in Mexico until the middle of the last century. Examples of this feather painting in its degenerate state are shown at the left and on the opposite page. At the bottom of page 490 is shown a featherworker practicing his craft, and from the pictures on pages 486 and 487 one can judge how important an adjunct to costume feathers were

This headdress (from Heger 1908) originally belonged to the ill-fated Moctezuma and was sent by Cortes to the Emperor Charles V, who in turn gave it to his nephew Ferdinand II of Tyrol. Kept in Ferdinand's castle at Ambras, this unique headdress finally became part of the collections of the Natural History Museum in Vienna





Feather- Work

The patient selection of different colored feathers and the care in joining them, as exemplified by this picture, made during the last century, is a direct expression of the Indian heritage in Mexico. It is curious to see in comparing this and the feather painting opposite with the costumes on pages 490 and 491 how little the dress of the Indian has changed with the ages. Only the trousers and the hat distinguish these people of 1850 from their ancestors of three centuries and a half before

the manufacture of an arrowhead whose every facet shows the skilled impress of the worker's hand.

ANCIENT MIRRORS

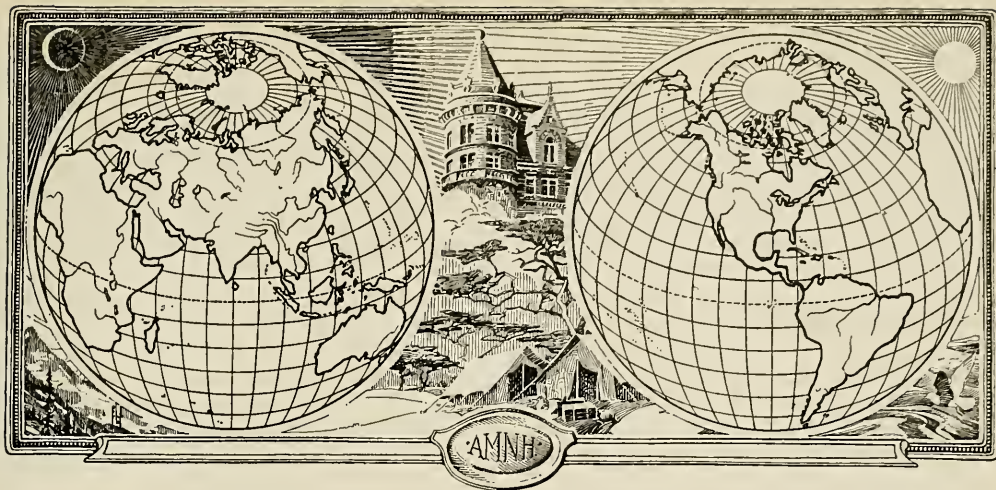
The manufacture of mirrors gives yet another aspect of Central American capability. There were in that region relatively few substances that could take a polish high enough to give a reflection. Glass and bronze were unknown, and copper never seems to have been used for such a purpose. The inhabitants did, however, make mirrors of iron pyrites and obsidian. Iron pyrites sometimes occur in small nodules on which a plane surface could be ground, giving a very satisfactory reflection. Another type of mirror consisted of thin plates of pyrites, laid like a mosaic on a backing of pottery or stone. Few complete specimens are known, but there do exist a number of stone disks which may well have been backs for such mirrors. It is quite probable that the celebrated mosaic disc from Chichen Itza could have had a mosaic of iron pyrites in its center. A unique mirror in the American Museum of Natural History utilizes iron pyrites in their original slate matrix, the pyrites being polished as a surface and the slate carved as an ornamental back. The obsidian mirrors of Central Mexico are among the wonders of ancient technology, since even a modern lapidary, with his diamond drills and carborundum wheels has difficulty in grinding down this volcanic glass to the lustrous sheen of early times. Mirrors of both materials must have been very precious, and it is not surprising that they were used

as much for divining purposes as to cater to the vanity of their owners.

The introduction of iron and steel tools has largely destroyed the ancient crafts of wood-carving and stone-work. Yet two very flourishing crafts survive, that may well have had a pre-Columbian origin. A plaster-cloisonné decoration of gourds is carried out at several points along the Central American Highland, and its prototype may be represented in pottery vessels from north-western Mexico, which are ornamented by similar means. No example of the beautiful lacquer trays from Guerrero and Jalisco survives from the indigenous civilization, but although their pre-Columbian origin may be doubtful, their manufacture was an exclusive Indian property in Colonial times.

ART IN EVERY-DAY LIFE

Thus vestiges of the ancient civilization exist today in some of the modern crafts. Those carvings and buildings which we have grouped under the Fine Arts were really projections of the common technical skill of the people. The virtual anonymity of most religious art fuses the humble crafts with the highest æsthetic expression. The attempts to inculcate "Art in the Home," so often made in modern times, would have been unnecessary in Ancient Central America. While the little-known may well present fictitious advantages, particularly in the case of civilizations viewed through the mouse-holes of archæological research, yet one feels that the Central Americans individually participated in their civilization to a greater extent than we do in ours



Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by
A. Katherine Berger

Southeastern Polynesia

Mr. Templeton Crocker is leaving San Francisco on September 15 on the "Zaca" for a scientific expedition to southeastern Polynesia, accompanied by Dr. H. L. Shapiro, Dr. James P. Chapin, and Mr. Francis L. Jaques, all from the American Museum of Natural History. The itinerary is expected to include the Marquesas, Tuamotus, Tahiti, Rapa, Mangareva, Pitcairn Island, Easter Island, and several islands off the coast of South America, as well as the Galapagos Islands. Doctor Chapin and Mr. Jaques will collect material for habitat groups of oceanic birds, while Doctor Shapiro will continue his extensive studies of Polynesian peoples. The Pitcairn Islanders will be a particular object for his genetic researches on the descendants of the mutineers of the "Bounty."

To Explore in Mongolia

Dr. George Gaylord Simpson has recently returned to the American Museum from Moscow where he started negotiations with the Mongolian Mission for permission to explore in Mongolia. He was cordially received at the Mongolian Mission, and only the lateness of the season and necessary slowness in communicating with the capital of Mongolia prevented his carrying out the plan immediately. Negotiations are still going forward, and it is expected that the necessary permission will soon be

granted and that Doctor Simpson will be able to return to undertake this important work.

The fossil material from South America which Doctor Simpson collected during the recent Second Scarritt Expedition to Northern Patagonia is now being unpacked in the American Museum laboratories.

Autumn Lectures

Five free courses for teachers, given by the American Museum in coöperation with the College of the City of New York, are open without cost to its members,—“Nature Study for City Teachers,” “Applied Physiology and Health,” “The Museum in Elementary Social Studies,” and two courses in “The Mechanics of Visual Instruction.” Students in “Applied Physiology and Health” will have the advantage of the results of original research carried on by Dr. G. K. Noble and Dr. H. J. Clausen of the Museum’s department of experimental biology and by Dr. W. K. Gregory of the department of comparative anatomy.

Four courses, given primarily for teachers, in coöperation with New York University are open to members and friends of the Museum, upon payment of the regular fees. These are “Astronomy for Teachers,” “Survey of Natural History for Teachers,” “The Museum in Elementary Education,” and “Primitive Culture.”

The regular Saturday afternoon showings of motion pictures will be continued, starting on October 6 with the talking picture, "The Silent Enemy."

A series of four Saturday afternoon talks on the Gem Collections of the American Museum will be given at the Museum by Mr. Herbert P. Whitlock, curator of gems and minerals, on October 20, 27, and November 3 and 10.

The Lectures for School Children of the city, supplementing their work in science, history, and geography, will be continued on Mondays, Wednesdays, and Fridays at 10:30 A.M.

The Sight Conservation classes for children with defective sight will be carried on as they have been for the past twenty-two years.

A new Special Activity Program, consisting of Finger Painting, Nature Crafts, and Miniature Group Making are included in the Exhibition Hall Talks offered to children of the public schools. This is an unusual opportunity for the child to complete, under expert supervision, a definite piece of creative work of his own choosing.

Ten free lectures on Biologic Science will be offered to students in elementary, general, and advanced biology by members of the Museum staff.

The Know Your Museum Series for Members will begin on October 30. There will be four evening programs, following a plan entirely different from that of previous years.

Crippled Children Guests of the Museum

During the past year about 600 crippled children from the public schools of New York City have visited the American Museum by special invitation. In groups of 20 or 25 the children were entertained with nature talks, followed by trips through the Museum halls containing material related to the subjects of the talks. All the children then went to the auditorium where they saw Martin Johnson's African film, "Simba." After a luncheon served by the School Relief Committee, the Museum guides took their guests to the Hall of Ocean Life, where, among the wonders of the sea, the Lindbergh plane, "Tingmissartog," is on view, together with the equipment carried by the Lindberghs on their last long flight. After enjoying another motion picture, the children were taken directly to their homes in school buses.

A School for Gardeners

Education in the sciences underlying the practice of horticulture is to be offered again this year in a course for professional gardeners sponsored by the New York Botanical Garden. The opening classes of this, the third year, will be held at 8 P.M., Monday, October 1, in the rooms of the Horticultural Society of New York. Prospective registrants

are expected to communicate beforehand with Dr. Forman T. McLean, supervisor of the course, at the Botanical Garden in Bronx Park.

Modeled, at present on a small scale, after the work given at Kew Gardens, in England, this course is the only one of its kind in the United States. It is definitely not a school of gardening, but a school for gardeners. Only those are admitted who have done actual work as professional gardeners for several years.

Subjects include systematic botany, plant morphology, plant physiology, soils and fertilizers, entomology, plant pathology, and breeding. The fee is \$5 for each set of twelve lectures, or \$20 a year.

Scientific Work in New Guinea

On pages 447-57 of this issue of *NATURAL HISTORY*, appears a series of unusual photographs taken on the American Museum's 1933 New Guinea Expedition. This expedition, which was headed by Richard Archbold, has now completed its field work and has been disbanded. The birds, mammals, and plants collected on the south coast of New Guinea in January and February, 1934, by the members of the expedition have just been received and unpacked, and a preliminary examination of the material promises much of interest and value.

This part of the collection comes from just west of the Fly River in South New Guinea, near the point where New Guinea most nearly approaches Australia and where the dry coastal belt of savanna closely resembles the savanna of North Australia.

New Guinea in general has a flora of Asiatic origin while its fauna is Australian and Papuan. Here on the south coast in the dry savanna both the flora and fauna strongly resemble that in near-by North Australia, the fauna being more closely related to that than is the fauna of the rain forest of the rest of the island. If New Guinea were not separated from Australia by the Torres Straits, it is probable that this savanna belt would be included in the Australian zoogeographic subregion, while the rain forest in northeast Australia (on Cape York) would be included in the Papuan subregion. As it is, perhaps this would be the best way to consider it.

Until this collection was made, the natural history of this part of the south coast was known only from the work of d'Albertis, an Italian from Genoa, who collected there about fifty years ago. Since then only a few collections have been made near Merauke in Dutch Territory farther west, but nothing further had been done in this particular locality. These lowlands seemed the most promising collecting field for the last part of the expedition's stay in New Guinea, and though the two months spent there were all too short for a thorough exploration of the flora and fauna, the results were considerable.

Much more evidence of the close affinity of South

New Guinea with Australia was obtained. The expedition secured the first specimen with authentic locality of the Australian echidna, *Tachyglossus aculeata*, spiny anteater or porcupine, as it is variously called. Birds were recorded such as the button quail (*Turnix maculosa*), savanna parrot (*Aprosmictus erythropterus*), ground dove (*Geopelia humeralis*), happy family bird (*Pomatorhinus temporalis*), white-naped honey-eater (*Melithreptus lunatus*) and the strawberry finch (*Neochina phaelon*) which have long been known to occur only in Australia and this dry belt of South New Guinea.

The expedition also collected for the first time in New Guinea the wedge-tailed eagle (*Ureoaetus audax*), cinnamon quail thrush (*Cinclosoma cinnamomea*), noisy friar (*Philemon corniculatus*) and the little friarbird (*Philemon citreogularis*), all Australian species. Along the coast was made the first record of the Australian silver gull (*Larus novae hollandiae*).

Besides these new records for New Guinea, this collection extends the range of other New Guinea forms which further study may prove to be new subspecies. Much material that will be valuable for future comparative study was also collected.

The botanical collections made by Mr. L. J. Brass, botanist for the expedition, form the largest and most important single collection of such material so far made in British New Guinea. Mr. Brass is an experienced collector, having prosecuted extensive field work in botany in Queensland, and having made two previous botanical expeditions, one to the Solomons, and one to Papua. The collections made in 1933-34 comprise about 2500 numbers, with about 15,000 specimens. The material is ample, with an extensive series of duplicates, is beautifully prepared, and the specimens are supplied with particularly ample field notes.

Mr. Brass made collections wherever it was possible to do so in connection with the field work of the expedition, some at low altitudes, some at medium altitudes, and much at the higher altitudes on the Albert-Edward Range. He gave particular attention to those species characteristic of the primary forests, as a result of which it is found that the magnificent collection recently received is particularly rich in New Guinea endemics. He did not confine his field work to obtaining the most obvious and the most easily secured material, but collected an excellent series of those coarse species often ignored by collectors, such as the palms and pandans. While the bulk of the collection represents the flowering plants, ferns, and fern allies characteristic of the primary forests, the lower groups such as the fungi, lichens, mosses, and hepatics were not overlooked. The collection is peculiarly rich in ferns and fern allies. High altitude species are particularly well represented in all groups. The collection is now under study, at the New York

Botanical Garden, and, when this task is completed, it will be found to contain a very large number of new species. The published results based on this collection will make a most valuable contribution to our knowledge of the particularly rich Papuan flora.

Mr. Archbold is to be congratulated because of the fact that he made his Papuan expedition one of general biological interest by securing a vast amount of material in groups outside of his own special interest, mammalogy.

Man's Fight Against Disease

The public health exhibits of the American Museum have been completely rearranged in the new Hall of Biology and Public Health, which was formerly one of the engine rooms of the Museum. Among the new exhibits is a large physiographic map of the New York City area, showing the struggle of the City against water pollution. On this map the incinerators and sewer screens are located and the degree of pollution of the waters of the New York City area are indicated. Many of the smaller groups, showing the fight against sleeping sickness, typhus fever, etc., have been provided with backgrounds which make them much more interesting and significant to the public. The largest of these groups shows the methods of preventing rats from infesting ships. Rats harbor fleas which may transmit the plague germ. The story of man's fight against disease and his methods of building up a strong and healthy body are shown in this new hall.

Errata

Due to an unfortunate editorial error in the July-August issue of *NATURAL HISTORY*, the unusually handsome photographs that illustrated the article on Chinese Turkestan were credited to the author, James L. Clark. Some of these, it is true, were taken by Doctor Clark, but most were taken by Mr. William J. Morden, the organizer and leader of the Morden-Clark Expedition, which crossed Chinese Turkestan in 1926 on its way from India to China.

In the July-August number of *NATURAL HISTORY*, page 329, under the painting of a restoration of a Mosasaur, the legend read: "By Charles R. Knight, after Henry Fairfield Osborn." The painting was by Charles R. Knight; it was based on a fossil skeleton described by Professor Osborn.—W. K. G.

Library

On June 1, after thirty years of faithful and enthusiastic service to the American Museum Library, Miss Ida Richardson Hood, who was assistant librarian from December 26, 1903, to January 26, 1926, and curator of books and publications since that date, retired from her duties.

Taking up her work at the Museum just a few months after the appointment of Dr. Ralph Winfred Tower to the position of curator of books and publications, she was privileged to share with him in the interesting though stupendous task of building up a library worthy of this rapidly growing and increasingly important but still fairly young Museum. She was thus well equipped to take over the reins when, through his premature death, in 1926, Doctor Tower was forced to lay them down. The Library, as well as the entire Museum staff, is feeling the loss of her gracious and wise administration, but is rejoicing with her in her prospect of new happiness and refreshing leisure.

In assuming the duties of acting curator of books and publications, Miss Hazel Gay is endeavoring to maintain the high ideals and standard of service set by her predecessors.

Honors

On June 12, Lehigh University, awarded the degree of Doctor of Science to Barnum Brown, curator of fossil reptiles at the American Museum, for his distinguished work in palaeontology.

A Birthday

A surprise luncheon by the members of the Scientific and Administrative staff was tendered to Dr. Frank M. Chapman, dean of the curators of the American Museum, on the occasion of his seventieth birthday. Appropriately, the setting was the Flying Bird Hall of the Museum. During the luncheon a birthday cake bearing lighted candles was borne to the birthday table and placed before Doctor Chapman amid the applause of the guests. Tributes to Doctor Chapman's long years of devotion not only to the American Museum but also to the study of the bird life of the world were given by Witmer Stone, Henry Fairfield Osborn, Roy Chapman

Andrews, and Robert Cushman Murphy, under whose auspices the luncheon was arranged.

Recent American Museum Publications

During May and June the following *Novitates* and *Bulletin* were published by the American Museum:

NOVITATES

- No. 716. Two New Species of Sheep-Like Antelope from the Miocene of Mongolia. By Guy E. Pilgrim.
- No. 717. Ambicoloration in the Winter Flounder. *Pseudopleuronectes americanus*. I, II. By E. W. Gudger.
- No. 718. An Apparently New Fruit Bat of the *Pteropus hypomelanus* Group from Gower Island, Solomon Islands. By G. H. H. Tate.
- No. 719. A New *Gambusia* from Andros Island, Bahamas. By C. M. Breder, Jr.
- No. 720. An Apparently New Family of Amblypod Mammals from Morgolia. By Walter Granger and William K. Gregory.
- No. 721. Foraminifera from the Ross Sea. By A. S. Warthin, Jr.
- No. 722. The Solitary Bees of Barro Colorado Island, Canal Zone. By Herbert F. Schwarz.
- No. 723. More New Fishes from the Kasai District of the Belgian Congo. By J. T. Nichols and F. R. LaMonte.
- No. 724. Notes on the Syrphidae in the Slosson Collection of Diptera. By C. H. Curran.
- No. 725. A Silicified Shelf Fungus from the Lower Cretaceous of Montana. By G. R. Wieland.
- No. 726. Further Notes on American Spiders. By W. J. Gettsch.
- No. 727. Sarcophaginae of the American Museum Congo Expedition (Diptera). By C. H. Curran.
- No. 728. Studies of Peruvian Birds. XIII. The Genera *Dendrezastates*, *Campyloramphus* and *Dendrocycla*. By John T. Zimmer.
- No. 729. A Pliocene Flora from the Eden Beds. By Daniel I. Axelrod.
- No. 730. A New Genus and Species of Scaleless Blenny, *Somersetia furcata*, from Bermuda. By William Beebe and John Tee-Van.
- No. 731. The Social Bees (Meliponidae) of Barro Colorado Island, Canal Zone. By Herbert F. Schwarz.
- No. 732. New and Little-Known Western Bees. By T. D. A. Cockerell.

BULLETIN

- Vol. LXVII Art. V. Revision of the Hyrachyidae. By Horace Elmer Wood, 2nd.
- Vol. LXVII Art. VI. Petrology of Stone Artifacts from Mongolia. By L. Erskine Spock.

ANTHROPOLOGICAL PAPERS

- Vol. XXXIII Pt. V. The Hidatsa Earthlodge. By the late Gilbert L. Wilson. Arranged and Edited by Bella Weitzner.

Recently Elected Members of the American Museum

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Life Members

Messrs. WILLIAM C. KING, JR., DUNCAN H. READ.

Sustaining Member

Mr. DAVID B. MILLS.

Annual Members

Mesdames C. W. HULST, SHERLEY W. MORGAN, WALTER L. NILES.

Misses ANNA B. BYERS, MARY DEMEREC, BRENDA KUHN, FRANCIS I. NEILL.

Messrs. GEORGE T. HASTINGS, J. KELLY JOHNSON, WM. J. MCKENNY, HAROLD E. BLANCHFORD, WILLIAM L. KLEITZ, F. EUG. NORTZ, GUSTAV OBERLAENDER, WILLIAM E. RHODES, PAUL T. RICHARD.

Associate Members

Mesdames HAROLD BACHMANN, CLAS. J. DEERING, JOSEPH DUMOND, C. H. FREUND, GARRET J. GARRETSON, DIEDRICH GRISTED, LOIS MAZEP, IRVING MCKESSON, ROBERT B. PARKER, C. A. RAYMOND, J. WARREN RICE, FANNY SCHLESINGER, SARAH W. SMITH.

Misses CAROLINE E. BERRY, FRANCES ANNE FARRELLY, RUTH A. HOLDER, WILMA JUNGER, ELISE H. KINKEAD, FLORENCE MARSH, ADELE MATTHIAS, MARGARET SHEARER, HANNAH SMITH, LUCIA TEMPLE, DAGNY TISCHENDORF, ELIZABETH VAN DER MERWE.

Doctors THOMAS HORACE EVANS, NATHAN W. GREEN, TRYGVE GUNDERSEN, A. J. T. JANSE, ELMER LEE, ELWOOD HALL MACPHERSON, CHARLES HORACE MAYO, HOWARD PATTERSON, J. EUGENE REGUA, HARRY A. SIFTON, MARTIN SODERGREN, S. M. STRONG, DANIEL SULLIVAN.

Colonel SAMUEL REBER.

Honorable CLARENCE Y. PALITZ.

Messrs. GEORGE O. ALLAIN, JR., SHALOM ALTMAN, HUGH H. ANDERSON, HENRY D. BARROW, WILLIAM BECKER, WILLIAM R. BIGGS, R. A. BROWNELL, JULIAN BURROUGHS, E. DON. CAMERON, CASS CANFIELD, SYDNEY B. CARPENDER, CORLIES R. CARTER, ISADORE COHEN, JR., WM. F. COLEMAN, ARTHUR R. CURRY, EUGENE ADELOR DE ROSIER, HENRY A. HAHN, CHARLES HECHT, HAROLD HEYMAN, ALBERT HOLZER, JOHN E. HUBBARD, E. J. HUDSON, JOHN F. IMIE, B. L. JENKS, THEODORE T. JOHNSON, WINTHROP J. MEANS, G. H. V. MELONE, HORACE R. MOORHEAD, RICHARD C. MURPHY, ANDREW J. NAMM, GEORGE OENSLAGER, W. E. PARKINS, A. S. PETERS, W. E. PHELPS, P. PORTA, ARTHUR H. RAHMANN, W. E. RANSON, R. F. I. RAYMOND, W. V. READ, E. M. RICHARDS, C. E. RIECK, EDWARD C. ROBERTS, KARL RUPPERT, ROBERTS K. SKINNER, JR., CHARLES H. STANTON, ROGER SULLIVAN, J. M. TATE, JR., ARVID E. TAUBE, R. B. VANDEGRIFT, LESLIE VAN EEGHEN.

Collecting Insects in the Grand Cañon

Curator Lutz and Mr. E. L. Bell of the American Museum and two volunteer assistants spent the summer in southwestern Colorado and northern Arizona for the purpose of collecting and making observations upon the very interesting insects of that region. Their work took them to the very bottom of the Grand Cañon and to tree-line near the tops of near-by mountains. There are few regions in the United States where such a vertical range exists in so short a horizontal distance. With changes in altitude go corresponding changes in fauna and flora so that within a few miles there are to be found representatives of the life of our continent from the Mexican plateau to the shores of Hudson Bay. Probably less than half of the insects living there have been recorded and many of the species are "new to science" in the further sense that they have never been described.

Beaked Whales

Two specimens representing two species of rare beaked whales were cast up on Rockaway Beach, Long Island, approximately twenty miles from the American Museum of Natural History. The first came ashore on December 22, 1933, and the second about a mile farther west on the same beach on January 14, 1934. Through the kindness of the Rockaway police and other officials the Museum was notified in each case and the specimens were guarded until they could be sent for.

Now that the skeletons of the two animals have been prepared, it is possible to identify them with certainty. The first specimen is known technically as *Mesoplodon europaeus* and measured fifteen feet, four inches, in the flesh, a female, apparently adult. The type and for a long time the only known specimen of this species was found floating on the surface of the sea at the entrance to the English Channel. It was taken in tow by a French ship and later described and named by the French naturalist Gervais in 1848. Dr. F. W. True of the United States National Museum wrote a monograph of the beaked whales of the family Ziphiidae, which was published in 1910, in which he recorded two more specimens of *Mesoplodon europaeus*, both taken on the New Jersey coast, one at North Long Branch and the other at Atlantic City. An examination of recent literature has failed to show any new records. Thus the specimen stranded on Rockaway Beach on December 22, 1933, is the fourth known specimen of its kind and the first to represent its species in the collections of the American Museum.

The animal stranded at Edgemere on the Rockaway Beach on January 14, 1934, was sixteen feet long and also proves to be rare. At first it was thought to be of the same species as the former, but when the skull was prepared, it could be positively identified as *Mesoplodon mirum* or True's beaked

whale. This is the fifth known specimen of the species recorded to date. The only other American record is the type specimen, which was captured at Beaufort Harbor, North Carolina, in 1912. The remaining three specimens were all stranded on the coasts of the British Isles.—H. C. R.

More Sea Serpents

As an aftermath of the article "Sea Serpents" by Dr. W. K. Gregory that appeared in the July-August issue of *NATURAL HISTORY*, the following letter has been received by the author just in time to include it in this issue:

DEAR DR. GREGORY:

Noting your article on "Sea Serpents" in the last number of *NATURAL HISTORY*, I was reminded of an experience some years ago which may interest you.

At one of Dr. Graham Bell's evening gatherings at his home in Washington, there were present among others Doctor Dall of the National Museum, Admiral Peary, and Edward S. Morse of the Essex Museum. The subject of sea serpents came up and various persons gave their idea as to what they might be.

Peary, I remembered, thought that birds flying close to the water might easily be mistaken for a sea serpent, and claimed to have seen what afterward proved to be a flock of birds which when first observed looked like a continuous snakelike body.

Professor Morse was the only one in the group who claimed to have seen a sea serpent. He was on a small boat in the China Sea when word was brought to him that a sea serpent was following the boat. Rushing on deck, he was astonished to see a creature trailing the ship which, as he said, agreed perfectly with his idea of a sea serpent. There was a huge head with straight horns on each side and about twenty or thirty feet of a round body, brown in color, showing above the water. Naturally he was much excited, and insisted that an effort be made to catch the monster. The Captain and crew were not nearly so anxious, but Morse insisted he must at least get a drop of the blood from the animal. Finally with the aid of grappling irons and pulleys, the serpent was brought up on deck, where it proved to be a log with roots attached which if they had been specially carved could not have made a better head for a sea serpent.

Doctor Dall had what to me seemed one of the best explanations of some of the reports on sea serpents. He pointed out that whales when harpooned often spewed up the content of their stomach, and in this way he had seen the tentacle disks of the giant squid twice the size of any that had ever been recorded for a live squid. He believed that if the tentacle was as much longer as the disk was larger, that such a thing waving about on the surface of the water would provide an ideal sea serpent.

I am,

Yours very truly,

GEORGE T. MOORE, *Director*,
Missouri Botanical Garden, St. Louis.

Blind Fishes

A note in the July-August issue of *NATURAL HISTORY* concerning specimens of blind fishes presented to the American Museum by Van Campen Heilner stated that these fishes were the first to be collected near Alacranes, Cuba. It is now brought to light that about twenty years ago Prof. Thomas Barbour of the Zoological Museum in Cambridge, Massachusetts, with Mr. W. S. Brooks collected a series of blind fishes from this same locality. Some time previous to this, Prof. C. H. Eigenmann reported good collecting of blind fishes near Alacranes.

Anthropologists Meet in London

Professors William K. Gregory and George E. Brewer were official representatives of the American Museum of Natural History at the International Congress of Anthropological and Ethnological Sciences, held in London from July 30 to August 4. Professor Gregory read two papers before the Congress at the invitation of the Anthropological Section.

Reviews of New Books

Recent Publications For Those Interested in Nature

Attending Marvels: A Patagonian Journal. By George Gaylord Simpson. The Macmillan Company, New York. 1934. xiii+295 pps., 16 illustrations.

THIS is only the modest narrative of a fossil hunter's expeditions into a land no more barren or terrifying perhaps than many others where fossil mammals are to be found. Yet it is the kind of book from which a reviewer longs to make frequent and liberal quotations. Other North American palæontologists have invaded Patagonia, have come back laden with fossils and eventually have published their journals in narrative form. To plough through the longest of these works is a task for only the most determined reader. *Attending Marvels*, on the contrary, sweeps us along on its own current; in the end we are ready to go even further than other reviewers, who have compared it favorably with Hudson's classic books on the Patagonia of Victorian times. What a panorama of past and present ages the author reveals to us; and what muddle-headed, tragi-comic specimens of *Homo sapiens* strut through his pages!

Not the least value of this book is that it will supplement the author's technical descriptions, in the scientific publications of the American Museum, of his priceless Patagonian fossils, which ever since the book was written are opening up new vistas of the evolution of these strange South American beasts. Scientists, in spite of comic tradition, are people, and the author's vivid but evidently effective descriptions of the geological history and present appearance of the country will be just as refreshing to students of geology and palæontology as they are to non-professional readers. Students of race mixture and of the way that social and linguistic barriers react upon their owners in a strange land will find much to interest them in the accounts of the Dutch and Welsh settlers in Patagonia. Naturalists will appreciate the many first-hand observations on the behavior of armadillos, guanacos, native ostriches, and other creatures. But we resist again the strong temptation to begin quoting. The reader will enjoy it better for himself.—W. K. G.

The Behavior of Animals. By E. S. Russell. Edward Arnold and Co., London. 184 pages, 6 plates and 26 figures.

THE behavior of animals may be dissected in the laboratory into its various components. Some of these are called tropisms, others reflexes of a simple or more complex type. The laboratory analysis may reveal the mechanism of response but it will fail to shed light on the significance of the behavior. Thus in the laboratory one animal may

be positively heliotropic, moving in a stereotyped manner toward light, and another species negatively heliotropic, moving away from it in the same forced way. A glimpse of the home life of these species will frequently reveal that the first lives in such a habitat that the easiest route of escape is toward the light and the other away from it. The significance of the laboratory experiment is merely that both animals under strained conditions are attempting to escape.

Professor Russell, in a series of lectures at University College, London, in 1933, made a plea for the study of animal behavior in its natural setting. The little book under review is an elaboration of these lectures. Such problems as insight and the perception pattern or *Gestalt* are considered from the standpoint of both the human and animal mind. Perception in even the lowest animal is something different from the physiological stimulation of the sense organs involved. The animal responds to the perception of the object in relation to its own needs. In other words there is a goal to behavior even when the animal has no knowledge of this goal.

In developing this thesis Professor Russell has drawn his illustrations from many different groups of animals. He has taken such homely examples as the dog who never listens to the radio but responds immediately to the bark of another dog because the "points of attention in her auditory world are few and specialized and are limited to such as are of 'dog interest.'" He also makes frequent reference to invertebrates, such as the limpet which, although blind, makes a practice of returning regularly to the same "home," a scar on the face of some rock. These many types of animals have this in common that they select "from the possible perceptual environment only those features which are significant in relation to their manner of life, and ignore the rest. In this sense each animal makes its own world of perception."

Professor Russell's book should prove of the greatest interest to the naturalist, for, while not undervaluing the work of the physiologist and the psychologist, he has emphasized the importance of recording fully and accurately the normal day-to-day activities of animals. It is only through a knowledge of these details that the significance of any one part of this behavior can be fully understood. Old-fashioned natural history if accurately and fully pursued takes its place with the more exact sciences which have the advantage of precise methods and adequate control.—G. K. N.

Rebel Destiny. By Melville J. and Frances S. Herskovits. New York. Whittlesey House, McGraw Hill Book Company, 1934. pp. xvii, 366. 15 illustrations.

REBEL destiny is a unique contribution to the literature of the forest and its primitive inhabitants. Written with a sensitivity and verve that is seldom found combined with scientific sophistication and accuracy, it gladdens the reader with its manner and convinces with its matter.

It is the story of Dr. and Mrs. Herskovits' trip up the Suriname River into the interior of Dutch Guiana, into the country of the Bush Negroes, the descendants of African slaves who freed themselves from their white masters during the first generation of their enslavement. Before they had lost the manner of life of their African home, they were able to reestablish it again in the South American jungle. From their stronghold they inspired respect and fear in their former masters. Arrogant, certain of the validity of their own customs and their own pride, they have maintained a coherent culture in this remote spot to which their ancestors were so brutally and fortuitously brought. While the white man invaded Africa with the products of machine civilization and the teachings of missionaries, the Bush Negroes remained free of such alien influences. As a result their customs are of very great importance to the student of African ethnology. But *Rebel Destiny* is not an ethnological monograph; the routine statement of the minutiae of the culture is reserved for soberer volumes. In this book we have instead the record of the way in which this culture impinged upon the senses and the understanding of two people who were privileged to see it vividly.

—MARGARET MEAD.

Traders to the Navajos. By Frances Gillmore and Louisa Wade Wetherill. Houghton Mifflin Company, Boston and New York, 1934. 256 pp. illus. bibliography.

THE Indian trader was usually the first white man to form intimate contacts with Indian life. At first these traders went out alone, taking Indian wives, usually daughters of chiefs. Later on came traders with their own families, among them the Wetherills. The present volume is a series of sketches, biographical and appreciative, of John and Louisa Wetherill, long resident in the heart of the Navajo country. To one who has traveled in that country the book will be more than interesting. Members of the American Museum will note brief accounts of well known American Museum achievements, as the early Hyde exploration work and the expeditions of Charles L. Bernheimer, long a friend of the Wetherills. There is a definite, authentic statement of how John Wetherill discovered the great cliff ruins of Mesa Verde and made them known to the world. There is also what seems to be a true account of the discovery of Rainbow Bridge; although Indians were the first to see it, it was John Wetherill who claims the honor of being the first white man to stand under its arch. Yet these

historical matters are incidental, the main treatment having to do with the experiences of Mrs. Wetherill as helper and advisor to her Indian friends, and her efforts to learn more of the Navajo point of view. The reader is carried from one incident to another before his interest lags, and though all are but glimpses of otherwise long narratives, yet in the end the reader will have a feeling for Navajo life and readily understand why so many people are fascinated by that country.—CLARK WISSLER.

The Jungle in Sunlight and Shadow. By F. W. Champion M.A., F.Z.S. Published by Chas. Scribners Sons. 1934. With 96 pp. of plates.

A GAIN, like his previous book, *With Camera in Tigerland*, Champion's latest narrative, *The Jungle in Sunlight and Shadow*, comes through the sultry haze of publications like a breath of fresh air to greet the nature lover and the layman, too, with its true and sympathetic lines and superb pictures of the wild life of the Indian jungles.

Champion's long experience as Forest Officer in the Indian Service has given him exceptional opportunity to follow his love of wild animal photography, and this book is a dramatic and colorful record of the thrills and dangers and pleasures that attend his favorite and fascinating sport. Reading it, one cannot help but feel the author's deep love and sympathy for all wild life, for he sees them not as "beasts," to be killed by blood-lusty sportsmen, but as beautiful creatures in nature's garden, to be saved as part of nature's great picture, to be observed and studied for the better understanding they can give us of life upon earth—"hunted," not to be killed, but photographed as they really are, pitting one's own wits against their supercunning, entering their very sanctuary and getting their portraits before they even sense suspicion.

How well I can appreciate Champion's great pleasures, his bitter disappointments, his patience and his trying hours of labor to accomplish what he has, for I, at different times, in company with two of his own countrymen, A. Radelyffe Dugmore and Cherry Kearton, have done this very work in Africa, sitting out on half a hundred nights, doggedly waiting for some denizen of the wild to come within range of our bait and camera.

I know the disappointment of failure night after night and the discomforts of long waits and of the many, many little things that can cause defeat. And so it is that I cannot too highly praise Champion's really great achievements in wild animal photography.

Exquisitely superb are all his photographs, with definition, composition, and true natural history—not fierce or frightened to death (as some think they should be), but quite peaceful animals, just as you really find them. Yet you almost shudder when you turn to the pages of the tiger portraits and see those glassy eyes peering at you.

This book is a real contribution to science, not only for these marvelous pictures, but also for its very instructive and well written text. How little we know of the life history of even our commoner wild animals! There is a vast store of knowledge to be gained, but it can never be gained with the gun, for the "student" with a gun usually kills first and wonders about the animal's habits afterward, when it is all too late.

All too soon our wild animals will be destroyed forever, and when that time comes, books like Champion's will live in their stead.—JAMES L. CLARK.

Creation's Doom. By Desiderius Papp. D. Appleton-Century Company, New York, 1934.

HERE is a prophecy on a grand scale. Nothing less than the solar system from its fiery beginnings to its final conflagration. Dr. Papp with strokes adjusted to the magnitude of his subject paints a panorama of the past and the future of the earth. By projecting the trends of the past into the future and by analogy with recurrent earthly and celestial events he confidently adumbrates the path that man will travel and, after man, his successors.

As a prophet I definitely belong with the minor ones, compared with Dr. Papp. He predicts a future man somewhat inconsistent in his physical traits, wholly appalling to our esthetics and perhaps worthy of a new zoological rating. This future creature will be completely bald, with an enormous head, a retreating, toothless jaw. Moreover, he will lack external cartilagenous ears, his foot will be reduced to four toes and his digestive apparatus will be reduced and adjusted to concentrated food in pill form. But more than this, *homo futurus* will have new senses and powers. He will have the ability to sense spontaneously the chemical nature of things, by means of spectroscopic powers to analyse various substances, and he will be able to send and receive radio messages via his brain. This miraculous superman will produce babies in the laboratory and when life becomes dull he will be able to suspend his life to some future epoch. Commensurate with these new organic developments, his control of nature will be equally superior to our own.

But man, if the creature described above may be so called, will not continue forever. His minute in the cosmic clock will soon end and the insect world will replace him, particularly the termites and the ants. This dynastic succession will occur when the sun has become much cooler than it is at present. Since the sun is the origin of life and upon its phases depend the character of the living organisms on the earth, Dr. Papp foresees with the gradual extinction of the sun a corresponding change on earth until the last representatives of life are gigantic unicellular organisms feebly surviving on the arctic earth.

Although the constant dangers threatening the

earth are vividly portrayed, Dr. Papp reassures us that the sun and earth will go on for countless years and die a natural death before it is finally consumed in the destructive fire.

Dr. Papp's reliance on certain guideposts will perhaps weaken the trust of some in his infallibility, but his wide range and his journalistic style will be a recommendation to those repelled by more orthodox scientific writing.—HARRY L. SHAPIRO.

Vanishing Wilderness. By Francesca R. LaMonte and Micaela H. Welch. 340 pages. New York, Liveright, 1934.

WITH sympathetic understanding and scientific accuracy, the authors of this beautifully written book tell the life stories of nineteen wild animals whose home is the fast vanishing wilderness. Each of the chapters deals with a different animal, ranging from our own American bison to the elusive okapi of Africa. Written in rich, simple style, with frequent touches of humor, the book is well suited to children of ten years or more, but no animal lover of any age should miss these delightful accounts of creatures that are becoming increasingly rare. A feeling of shame creeps over the reader as he realizes that, in most cases, man is solely responsible for the extermination of these splendid and defenseless inhabitants of the wild. The Junior Literary Guild did well to choose *Vanishing Wilderness* for its July book, and by so doing has placed both science and the cause of conservation in its debt. A short foreword by Dr. James L. Clark, vice-director in charge of preparation and exhibition, at the American Museum of Natural History, introduces the book. The format is pleasing, with a gay, orange cover and excellent paper and print. Two color plates and numerous pen and ink drawings by Captain Vladimir Perfilieff illustrate the next.

The book is full of human interest, the authors emphasizing throughout the importance of animals to man from earliest times. Wild creatures from every part of the world move across a background richly woven of historical and geographical incident, and of legend and folklore. Here we find answers to familiar questions too often ignored by the scientist, and many fascinating details about the private lives of animals from babyhood to old age. We learn how the animals got their names, where baby animals are born and how their mothers care for them, what they eat, how they play, how long it takes them to grow up, and how old they are when they die.

We see our own magnificent bison when "sixty million of them packed the plains." We follow the "wobbly-legged, scrawny baby" from the time when he ambles into the herd under his mother's protection, to the proud day some ten years later when he wins the place of "boss" of the herd. We grieve with him in his pathetic defeat by a stronger bull when he finally has to yield his leadership and

withdraw to the outer fringe of the herd to live his remaining years in loneliness. We learn how the giraffe came by its name and how it was long regarded by kings as a curiosity and a treasure. We watch a band of these fantastic animals running across the plains of Africa, "rocking their long necks in rhythmic balance," or find them standing up, asleep, with their heads among the tree tops. We sympathize with their difficulties in getting a drink—twenty minutes of straddling their long legs of contortions and manœuvres before they can get their mouths down to the water. We laugh to see the sleek little otters at play, coasting belly-whopper down hill and shooting into the water at the bottom. We read with mixed feelings of the spankings and caresses that the mother elephant administers to her baby with her trunk. We delight in the playfulness of the lioness as she rolls with her cubs, and admire the fine courage of her mate as he takes his last stand in the center of a band of Masai spearmen. The story of the unbelievable duck-billed platypus reads like a fairy tale.

The book closes with a delightful chapter on the shy and mysterious okapi, colored like chocolate candy, with white markings. So far as is known, no white man has ever seen him alive in his forest home. Perhaps some young reader of this inspiring book will one day be the first white man to see the okapi living in its remote African home.

—HAZEL L. MULLER.

A Field Guide to the Birds, giving field marks of all species found in eastern North America; by Roger Tory Peterson. Houghton Mifflin Company, 1934.

THIS little volume, of convenient size to be carried afield in the pocket, is surely destined to find its way into the hands of everyone in eastern North America who desires to become more familiar with the birds in their native haunts. A vast amount of information about the essentials of field identification is here collected and put into usable form.

Characteristics which are of no use in the field are kept out of the discussions, and emphasis is placed on those which may be most readily detected under varying conditions of light and distance. Thus the pattern and chiaroscuro of the bird's plumage are frequently of greater importance than the actual colors of which the light and dark areas may be composed. The hawk against the sky, or a line of ducks far out on the water, may show little color, but there may be certain bold marks which, if they can be seen, will tell the several species clearly. The outline of the bird in flight (where this is diagnostic), the shape of the outspread tail, the pointedness of the wing, the curvature of the bill or its angle of meeting the forehead,—these are often the characters on which the observer must depend for his identification of his subject, and they are well recorded in the monochrome drawings which illustrate a portion of Mr. Peterson's book. In the

case of many of the smaller birds of woods and open country, color is an essential detail, and colored plates are given where black-and-white would be inadequate. The particular patch or bar, or unmarked area which may have special importance in distinguishing a bird from another somewhat similarly plumaged species, is pointed out on the plate to show the observer what should be discerned to make recognition certain.

The text contains brief diagnoses of the various species with attention given to the special recognition marks, the possible sources of confusion, the characteristic mannerisms, and, sometimes, the peculiarities of song. Females, young, and fall or winter adults are discussed, when notably distinct, and compared with adult breeding males, even when no illustration is given of these additional plumages.

It is my opinion that the book would have been improved by having some scheme of reference between the text and the plates, for these are not always immediately adjacent. With an active subject in the bush, an observer may be unable to spare much time for hunting through the pages to get both discussion and figure in his mind's eye before the bird eludes him. The answer to this, at present, is to use the book frequently enough to learn the position of the respective items.

In the arrangement of the text, the species are taken up in the order of their systematic classification, which is fair enough and is an aid to the beginner in learning the relationships of birds. On the plates this order is broken and a certain arrangement by resemblance is followed, largely within the respective families. This, again, is quite satisfactory after the student has learned to tell a vireo from a flycatcher, or a kinglet from a wood warbler. If this stage of ornithological development has not been reached, there may be some difficulty experienced in finding the correct place in the book to begin the search. Doctor Chapman's familiar and historic *Color Key to North American Birds*, the precursor and foundation of works like the present one, occupies a niche in this field from which it has not yet been displaced, though its drawings are not the finished ones of Mr. Peterson's volume. There is much merit in a system whereby all the North American birds of confusingly similar coloration are placed together on the page for easy comparison of size and pattern.

None the less, *A Field Guide to the Birds* marks a distinct advance in works of its kind. Information of the sort which it presents is cumulative, and many years of practical experience have gone into its construction. The names of the various workers who checked the author's manuscript before its publication are assurance of the care which has been taken to make the book as accurate and up-to-date as possible.—J. T. Z.

The Bashford Dean Collection of Arms and Armor in the Metropolitan Museum of Art. Introduction and Biographical Outline by Carl Otto v. Kienbusch, Former President of the Arms and Armor Club. Catalogue by Stephen V. Grancsay, Curator of Arms and Armor, The Metropolitan Museum of Art. Published by the Southworth Press, Portland, Maine, 1932.

EARLY in his boyhood, the late Dr. Bashford Dean showed a marked predilection for at least two widely different fields in which to collect and study specimens: natural history (especially of fishes), and mediæval arms and armor. His work in both these fields continued until his untimely death.

He left a large collection of drawings of the embryos of certain archaic fishes. These are being incorporated in articles by various specialists and published in parts comprising *The Bashford Dean Memorial Volume—Archaic Fishes* under the editorship of the present writer. Five articles have already appeared. The first of these is a memorial by his former student, Dr. W. K. Gregory, in which Doctor Dean's life and zoological work are analyzed by subjects and epochs. A bibliography containing 315 titles comprises a full list of Doctor Dean's publications.

The memorial volume now under consideration has to do with the field of Doctor Dean's other major interest—that of collector and student of, and authority on mediæval arms and armor.

Doctor Dean had been honorary curator of arms and armor in the Metropolitan Museum of Art several years before he resigned his curatorship of fishes in the American Museum in 1912. In 1914 he was made curator in the Metropolitan Museum, a position which he held until 1927, when he resigned and was made a trustee.

Doctor Dean's work in this field resulted in making the arms and armor collection of the Metropolitan Museum the greatest in America and one of the four greatest in the world. Before his connection with the Art Museum, he had been engaged practically all his life in making an extensive private collection of arms and armor. After he became curator, by a special understanding with the trustees, the rule forbidding curators to deal in art objects was suspended in his case since it was understood that a large part of his collection would eventually come to the Metropolitan.

The year following his resignation from the staff of the Metropolitan Museum was spent in adding to his home in Riverdale a great Gothic hall in which properly to mount and display his own collection of arms and armor. By the irony of fate, death overtook him just when the armor was being arranged. By Doctor Dean's will one-fourth of his collection was given to the Metropolitan Museum. In addition, Mrs. Dean and Miss Harriet Martine Dean presented to the Museum many pieces of armor. Others were purchased and presented to the Museum by his friends. The whole constitutes the Bashford Dean Collection of Arms and Armor, the

greater part of which is catalogued in this memorial volume. Most of this armor is displayed in a special room in the Metropolitan Museum.

The quarto volume under consideration constitutes a memorial to Doctor Dean from the Arms and Armor Club of New York City. The first 48 pages are taken up with an account of Doctor Dean's work in biological science, in the service of the Government during the World War, and in the collection and study of mediæval arms and armor. This part of the volume is from the pen of Carl Otto v. Kienbusch, former president of the Arms and Armor Club. Included is a bibliography of 135 titles of his publications concerning arms and armor.

The main portion of the volume (230 pp.) is a scholarly catalogue of the 197 pieces of the Bashford Dean Collection now on exhibition in the Metropolitan Museum of Art. These priceless objects comprise such notable pieces as the helmets and elements of armor which came from the citadels of Chalcis and Rhodes and which are reminiscent of the Christian Wars in the East. There are no less than six harnesses of the Fifteenth Century, the best period from the viewpoint of form. Among the nine enriched harnesses of the Sixteenth Century, are included those of Philip II of Spain and of Duke Johann Wilhelm of Saxe-Weimar. Showing the mutual influence of costume and armor are elements of a puffed and slashed armor and a doublet and trunk-hose. Of outstanding merit as works of art are seven guns, with inlaid stocks, and one with a stock of sculptured ivory, bearing the heraldic arms of Philip of Croy; a sword made by the bladesmith of Cesare Borgia; and a helmet with a cock's crest, plumage and wattles skillfully represented, which was made by the court armorer, Jörg Seusenhofer of Innsbruck.

The careful descriptions of these 197 objects are supplemented by notes, comparisons, provenances, and bibliographies. They are illustrated by 63 quarto plates, 8 in line drawing and 55 (plus the frontispiece showing the Armor Hall at Riverdale) in collotype. The fine quality of these illustrations makes the volume itself a work of art. This catalogue is the work of Stephen V. Grancsay, Doctor Dean's favorite pupil, devoted assistant, and able successor. It deals with matters outside the present writer's field. However, even to an inexperienced eye, it is plain that Mr. Grancsay has put into these descriptions such a profound knowledge of the objects listed as will make this catalogue of the Dean Collection in the Metropolitan Museum one which will long rank among the outstanding memorials of its kind.

It is not often that a man succeeds so greatly in two such widely different fields and after death has erected for him two such monuments as *The Bashford Dean Memorial Volume—Archaic Fishes* and *The Bashford Dean Collection of Arms and Armor—Biographical Outline and Catalogue*.—E. W. GUDGER.



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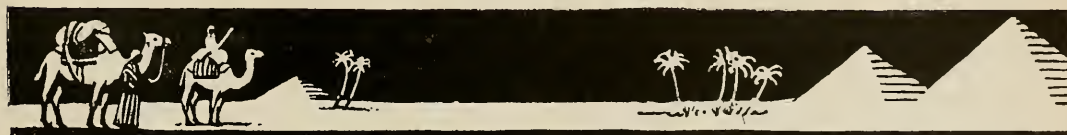
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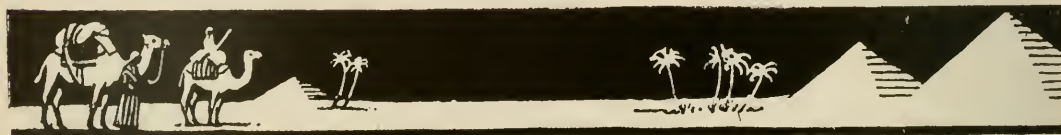
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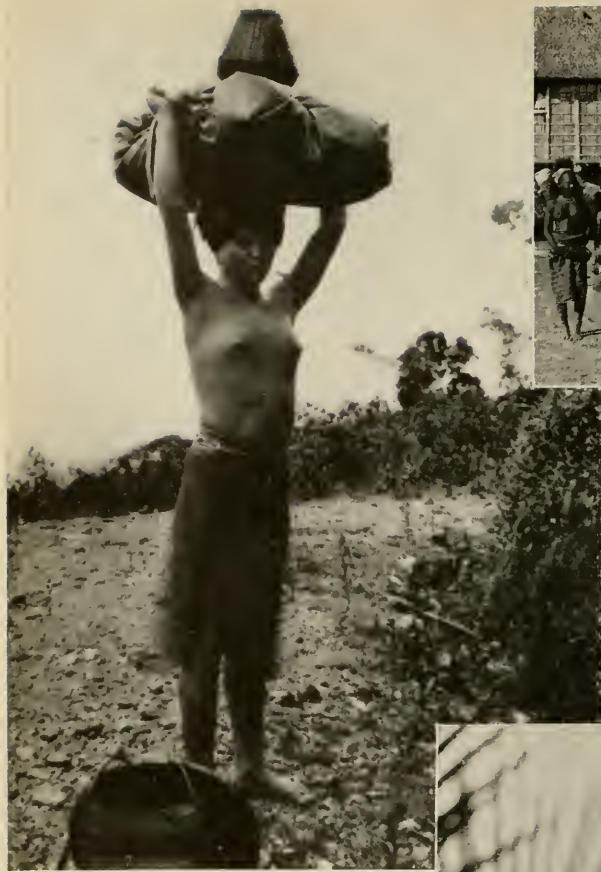
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Above:—A woman of the Ifugao people

Below:—A Moro. These Philippine Mohammedans presented one of the most difficult problems in the pacification of the Islands

Photo., Dean C. Worcester



Photo., Dean C. Worcester

Above:—These pygmies, to whom the Spaniards gave the name of negritos, or little blacks, were the first human visitors to reach the Philippines

Below:—A woman of the upper native class in Manila, wearing the costume which originated during the long period of Spanish rule

Ewing Galloway



Left:—A native family near Manila. The carabao, or water buffalo, is an important beast of burden to the rural natives



Ewing Galloway

Right:—A Bagabo Moro. A large part of the most dramatic of Philippine history could be written about the Moros. Following the introduction of Mohammedanism among them they became fiercely warlike, and from their bases in the southern portion of the archipelago made frequent raids upon other portions of the islands, more or less in the manner of the old Norse sea rovers of northern Europe



Left:—People of the terraced rice fields. The Igorotes have created a marvelous system of rice fields on the steep hill sides of the valleys they inhabit in Luzon

Ewing Galloway



Ewing Galloway

Above:—Rice is an important Philippine crop, and the carabao is an ideal work animal for use in the paddy fields

Ewing Galloway

Right:—Philippine women are shown here winnowing grain by the simple expedient of pouring it from baskets, while the wind blows the chaff away



Below:—Terraced rice fields near Baguio. These wonderfully constructed rice terraces offer real engineering difficulties, yet the Igorotes have carried this work on for many years

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Photo., Dean C. Worcester

Above:—A primitive sugar mill. Sugar has come to be one of the principal products of the islands—a fact that may present complications when independence is finally a reality, for at present Philippine sugar reaches the American market with a marked tariff advantage over the same product from certain other countries, and with independence this advantage will undoubtedly be lost

Coconuts are raised in large quantities in the Philippines, and, as shown in this view, are often transported by being made into rafts which are floated down the streams from the interior. Great distances must sometimes be covered, for the archipelago is more than one thousand miles in length, and while many of the islands are small, some approach or surpass the size of Ireland

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or just the pure love of adventure might cause the men of one village to go out on a raid. If successful, they brought the heads of the slain back to their town, where a great celebration was staged. There they sang the praises of the victors, and the youths were fired with the desire to show their prowess in battle. But the defeated village held a debt of blood against the winners, and at a favorable time sought to collect as many heads as they had lost. Thus feuds were built up which lasted through generations and prevented the growth of anything like tribal unity.

THE COMING OF THE MOROS

Despite these savage customs the people were advanced in many ways. They built substantial houses raised high above the ground on piles; they practiced a varied agriculture; they had dogs, chickens, pigs, and carabao. Their women had learned to weave and, while their ordinary garments were scanty, they had jackets for special occasions and blankets to wear about their shoulders. Somewhere in their travels they had learned the art of working iron with a forge, and in their smithies they made highly tempered head axes and knives. They had no written language, but a rich body of lore was chanted by their bards. Year by year these invaders came in greater numbers until the pressure of population carried them to all parts of the archipelago, and in their advance they drove the pygmies to the inaccessible fastnesses of the mountains or exterminated them.

Then came the Moro. About the year 1400 Arabian traders and missionaries first reached the southern Philippines. They had previously converted many of the Malayan islands of the south to Mohammedanism and, when they reached the Philippines, they were no less successful. Their conquest was a peaceful one, though there can be no doubt that the fact they possessed firearms, hitherto unknown in this part of the island world, helped them to gain an easy ascendancy. The new teachers es-

tablished themselves as rulers, and under their peaceful sway many warring villages were united.

Their conversion to Mohammedanism and the admixture of Arabian blood into the ruling class seemed to put iron into the blood of the converts. They became the Norsemen of the Orient. Trade was opened up between different islands and even with Borneo and Java, while their pirate fleets scoured the Sulu seas and made their name a terror. For purposes of convenience and protection they built compact villages far out over the water and these larger units made them a much more effective fighting force. In addition to their organization and fanatical bravery, they came into possession of firearms, and soon they were not only carrying on raids by sea but even the wild tribes of the southern islands paid them occasional tribute of loot and slaves. Sometimes they met their masters in the defending tribes and whole parties were cut to pieces, but this only added desire for revenge to the other incentives for battle. It seems certain that, had the arrival of the Spaniards been delayed one or two centuries, the adherents of Mohammed would have spread to every part of the Philippines. As it was, their outposts and settlements had reached Manila Bay when the white men first saw the Islands. Long after the Spaniards were established in Manila, they had to wage unceasing warfare with these fanatical pirates. With favorable winds their fleets would speed northward, leaving a trail of desolation in their wake. To guard against these raids, forts and watchtowers were erected at points of vantage, and these still stand as mute testimony to the prowess of the Moro warriors.

The discovery of the Philippines by Magellan checked the advance of the Mohammedans and led to the establishment of Spanish rule in these distant lands. It likewise led to the introduction of Christianity and thus set the stage in the Orient for a struggle between the adherents of these two great faiths—a struggle which today



Ewing Galloway

A Native House

Architecture in the Philippines runs the whole gamut from the extreme crudity of the Negrito's huts to the last word in modern construction, yet such thatched houses as the one shown above are probably more typical than almost any others



Photo., John T. Zimmer

Above:—The oldest fort in the Philippines—Fort San Pedro—erected by the Spaniards and used by them during their three-and-a-half century occupation of the Islands. It is located at Cebu



Left:—The Philippines were discovered by Magellan in 1521 during his famous first circumnavigation of the earth. It was to the Island of Cebu that he first came. He was killed on the neighboring island of Mactan. This pavilion, in Cebu, marks the spot where the Spaniards first celebrated Mass in the Philippines

Photo., John T. Zimmer



Photo., John T. Zimmer

Above:—The oldest street in the Philippines—Calle Colon, in Cebu. This first permanent European settlement in the Philippines was founded by Miguel Lopez de Legazpi, in 1565



Right:—An old Spanish watch tower. Many of these structures are still to be found in the Philippines, dating from the time when marauding Moros were a constant source of danger. As a protection against these piratical invaders such towers long played an important part

Photo., John T. Zimmer

offers one of the chief threats to the new Philippine nation.

SPAIN

The story of the next 350 years is one of absorbing interest, but we have space to note only a few of the events which lead up to the situation of today. Under the leadership of a nobleman named Legaspi the Spanish in 1565 began the task of exploration and pacification. Except for the Moro country, the conquests of the coast proceeded rapidly, sometimes by force, sometimes by peaceful means, but always aided by the industry and enthusiasm of the friars. These teachers established themselves in the various communities as fast as they accepted the rule of Spain. They found no great rulers; instead there were many petty chiefs, each fearful of the other and glad to accept the protection which the friars could give them. It is doubtful if history records another conquest of such magnitude with so little loss of blood.

We have already seen something of the people with whom these newcomers had to deal. Only a little advanced beyond the savage state, continuously at war with one another; some were slave holders; others men who decorated their homes with the skulls of their enemies; people whose gods demanded human sacrifice, yet despite all this men and women of great potential ability.

In the lowlands they were induced to establish their towns near the churches. Roads were built, courts established, but, above all, the people were taught the elements of the new religion. With Spanish rule came trade; European articles of dress and furniture began to appear, and many dwellings were built in Spanish style. In Manila and the larger cities the leading natives sought to copy the ruling class, and they in turn were imitated in the provinces.

With trade relations established, Chinese merchants entered the Philippines in great numbers. They occupied one large section of the capital city, and in every settled vil-

lage they opened stores. Usually they came without their families and quickly began to intermarry with the natives. Thus there sprung up the large mestizo or mixed blood group which today forms an important element in the population.

In the south the Moro still held sway and often made raids on the Christians. Back in the hills the pagan tribes continued their old life and customs, but generation by generation the settlements along the borders was absorbed by the civilized peoples, until in some islands the pagan element completely vanished.

Then came the decline and eventual downfall of Spanish rule. Land difficulties, corruption, intolerance, and the continued exclusion of the natives from participation in the Government, all played a part in the growing discontent which finally culminated in a series of outbreaks.

THE UNITED STATES

In 1898 a particularly threatening rebellion was under way when America declared war on Spain and Dewey's fleet entered Manila Bay. The events which followed form a little known chapter in American history. For three years our troops were engaged in stamping out insurrection. The country, already impoverished by the struggle against Spain, was further devastated. Public buildings were occupied by troops; bridges, railways, and telegraph lines were destroyed. People were called from all productive labor to fight the new invaders. At the end of the struggle the islands were prostrate but the spirit of the people was unbroken.

America made great promises. She declared she would give independence to the Filipinos as soon as they showed themselves capable of maintaining a stable government. She promised education, native participation in government, freedom of press and religion, and development of communications. Most of these promises have been fulfilled. Now the day of liberation is at hand.

In the preceding pages we have followed the racial and cultural movements into the islands. What of the present situation?

CHANGES THAT HAVE COME

In the mountains of Luzon, in the interior of Mindanao, in Palawan and to a lesser extent in other islands, the pagan tribes are still to be found. They probably number less than a million individuals, yet they dominate large areas. However, they are no longer the "wild men" first encountered by the Spanish and Americans. Head-hunting has practically vanished and inter-tribal warfare has ceased. Under American rule roads and trails have penetrated the most remote regions and with them have come profound changes.

A few months ago the writer had occasion to revisit a district which twenty-five years ago was typically pagan. In those days ordinary dress of the man was a clout and a belt from which hung a bush knife or head axe. When groups went on the trail, they carried spears to be used in case of attack. The women, when at work, wore only a wrap-around homespun skirt. Strings of beads held their long hair in place, while strand upon strand of colored beads covered their arms.

The houses, raised high on piles, had few of the furnishings found on the coast; there were no beds, chairs, tables, or lamps. No stores or market places were to be found in their villages, and schools and churches had not yet penetrated far inland. Spirit houses appeared at various parts of the towns and around these the people carried on elaborate ceremonies for the spirits who guarded their destinies.

On special occasions they went in parties to the market in some Christianized town, but their stay was brief, and they showed no confidence in their civilized kinsmen. Often when asked why they did not do certain things, they would shrug their shoulders and say, "It would make us look like Christians."

Now a hard road has penetrated a part of

that region and passenger-carrying trucks go daily to and from Manila. The villages on the road are no longer isolated. Traders come and go to an open market in the center of the town. A little store furnishes canned goods, coal oil and cheap cloth. Near by is the public school and church. One searches to find even a single spirit house, and inquiry soon discloses that the old ceremonies are almost a thing of the past. The dress and house furnishings are those of the coast, and the men now talk politics, gold mines, or the depression, rather than head-hunting.

THE PASSING OF THE "WILD MEN"

Even where contacts have been less violent great changes have taken place and the "wild men" are being rapidly merged into the Filipino population. Like all people in transition they have paid a price for their new toys. The elders have seen the old standards abandoned, they have seen the young people forsake the ceremonies and ridicule the sacred places. They have seen cock-fighting and gambling deprive their families of their lands; they have seen the old moral code shattered. To them the passing of the old order is a catastrophe. There can be no doubt but that the old life has been completely disorganized and with it the lives of many individuals who have been brought up during the period of change. But the children of today are being raised as Filipinos and they and their children will be merged completely in the new nation. There will be no reservations for the "wild men" for there will be none. Since they are of the same race and language groups as the civilized peoples, no such bars will hinder assimilation. The wild tribes offer no insoluble problems for the new nation.

Coming to the Christianized peoples,—the Filipinos,—we find them divided into many groups—Ilocano, Tagalog, Visayan, Pampanga, and so on through a long list. In general, these divisions represent linguistic groups, but all are closely related dialects of Malay, and it is an easy matter

The old and the new. Manila, since 1572, has been the administrative headquarters of the Philippines, and now has come to be an important modern commercial center. Nevertheless, side by side with modern structures and modern mechanical equipment are to be found old, and in some cases, almost archaic structures, equipment, and methods



Ewing Galloway

Bullock cart and automobile. Such contrasts are not rare in the far-flung Philippine archipelago

Manila

A modern and almost foreign note is the classic architecture of the new post office in Manila. In thirty-six years, however, much of the atmosphere of the largest city of the islands has been radically changed

Ewing Galloway



Ewing Galloway

Right: — The Pasig River, as it runs through Manila, has taken on much of the atmosphere of the Thames or the Hudson. This picture certainly suggests the Far East much less than it does the West



for a native from one group to acquire a speaking knowledge of another. In addition to this a large number in every region now speak English or Spanish.

Physically there is great similarity in all the population—pagan, Christian, and Moro. All belong to the Malayan race, which in turn forms one branch of the great Mongoloid division of mankind. The description for the pagan tribes applies equally well to the coast peoples except where intermarriage has produced a mixed or mestizo population.

Within the linguistic groupings are the provinces which, in the Philippines, compare with the states in America. There are provincial rivalries and a certain amount of group consciousness between language divisions, but they are not greater than the regional differences in the United States.

Mestizos, or mixed bloods, because of better advantages in the past, play an exceedingly important rôle, but they merge imperceptibly into the general population. As a matter of fact, a larger part of the mixed group is the result of intermarriage between Filipinos and southern Chinese, two groups belonging to the same racial division.

THE FUTURE

In the larger cities where there is an accumulation of wealth the homes reflect Europe and America as closely as tropical conditions permit. Until recently the dress of the women continued to be that of Spain of the time of the conquest, but today the school girls and younger women are copying the modern modes. Public schools have been crowded throughout the period of American occupation, while higher education has been given to a large number in normal schools and the University of the Philippines.

A good export trade has been built up in hemp, copra, sugar, and tobacco, while imports have greatly increased. Yet to a surprising degree the Philippines are self-sustaining.

As one goes into the provinces he finds a lower standard of living than among the rural populations of America or much of

Europe, yet comparing favorably with the most advanced peoples of Asia.

During the years since Dewey's victory, the Filipinos have been given increasing participation in the government until today they are practically self-governing. Those acquainted with the Islands know that a number of very able political leaders have arisen, but up to the present time there has been but one issue—independence. With that settled, there are already signs of the development of strong political factions, and it seems that the Philippines are to enjoy all the questionable advantages of our party system.

Probably the greatest internal threat to the new nation lies in the Moro population. In race and language they are similar to the rest of the Filipinos, but religion and a long tradition of conflict raise barriers to unity. Throughout the days of Spanish rule there was constant warfare between Christian and Mohammedan. America broke the power of the *datus*, or rulers, but sporadic outbreaks have taken place even within the last few months. However, there never has been a time in the last three hundred years when relations have been as friendly as now. In some sections of Mindanao, Christian and Mohammedan settlers are living peaceably in the same valleys. The Moro are comparatively few in numbers, less than one-sixth the total population. Yet they have shown themselves powerful adversaries. It will require all the tact and political sagacity of the Filipino leaders to bring this element into a united nation, but it can be accomplished if complete freedom is maintained in political and religious matters.

Three and a half centuries ago most of the population of the Philippines was on a cultural level no higher than that of the pagan tribes we have described. Under Spanish and American rule and through contacts with other peoples they have progressed far on the road we call civilization. Their past history promises much for the future, and we may predict for them a high place among the nations of the Orient.

My Florida Bird Guests

Observations made at the edge of a Miami garden during a second season

by
Frank M. Chapman

Curator-in-Chief,
Department of Birds
American Museum

Photographs by the author

In the January-February, 1934, issue of NATURAL HISTORY, Doctor Chapman recorded his observations for the first season he spent at his Miami home. The following article is thus, in part, a continuation of the earlier one, though each is complete in itself.—THE EDITORS.

IN November, 1933, I wrote to my Florida landlord of the preceding winter that I would re-rent his place on Biscayne Bay if he would assure me that there had been no change in its surroundings. This implied that the bird blind I had built in the adjoining mangrove swamp was still in position. Since this edifice was on neither his ground nor mine, it was unfair, perhaps, to expect him to be responsible for its existence. But, as a matter of fact, it was this 6×7-foot shack, not his Spanish villa, that I wanted.

I did not ask him to promise the presence of my bird companions of the past season. That, I felt, was to be arranged between them and me; and I had sufficient faith in their constancy to believe that, if they were alive, they would again be my guests. So I signed the lease and paid my rent. It remained to be seen whether I had taken merely a house or whether there were birds to go with it.

The result was of both personal and ornithological interest, and every bird-lover can imagine the feelings with which, on the morning of December 12, I distributed food in the accustomed places and then entered the little study in which I had passed so many productive hours to await the response to my invitation. At first it was disappointing. The place itself showed so little change; the log at my doorstep on which the wild-

cat had walked, the crab-holes, the vegetation, the feeding-table were all so exactly as I had left them that I found myself expecting to see the same birds in the same places. I forgot, for the moment, that for more than seven months they had not been fed here; that there was no unfailing feast; no concentration of food. Meals now had to be hunted; a mouthful here, another there. Experience, or the actions of their fellows, must tell them that last winter's Providence had reappeared. So, slowly, bird by bird, the guests assembled, until, at the end of a week, I had a company which, with few exceptions, was surprisingly like that of the preceding year. The exceptions were the comparative absence of red-winged black-birds, the entire absence of blue jays, and the presence of ground doves. In 1933 twenty-odd redwings, mostly females, came daily. This year only three or four of both sexes were present. This number included a one-legged adult male, presumably the individual of 1933 whose infirmity apparently still made him an outcast. The blue jays, I felt, had proved attractive marks for a boy with a .22 rifle; a single jay appeared on April 9, but at that time they were moving everywhere, doubtless in search of nesting-places.

There were two pairs of ground doves. They came daily and were most welcome. As for the others, there were six to eight each of cardinals, catbirds, and painted buntings, or essentially the same number as last year, and one each of the hermit thrush, northern or Maryland yellow-throat, and mocking-bird, or exactly the same number as last



The hermit thrush asked for
no recognition of its rank as
America's first songster and
always waited for others to
finish before it took its share
of suet

After it began to nest the
ground dove came alone,
leaving its mate to incubate



A three-storied dining table
with cardinal, painted bunt-
ings, and catbird at their
breakfast





A catbird and cardinal register doubt as to who has prior claims to the food before them



A mockingbird shows no jealousy toward its double in the mirror, indicating that it was not on its territory

Catbird and painted bunting lunch more peacefully together than would two individuals of either species



year. The first two I believe were the same individuals; the mockingbird, I am equally confident was not. Of the company of 1932 there were lacking in species, beside the blue jay, only the myrtle warbler and oven-bird. Each had been represented by a single bird, and a score of reasons can be given for their failure to return. In their stead a Florida or white-eyed towhee, very much out of place in a mangrove swamp, came almost daily until February 17. After that his high-pitched whistle *towhee*, so different from the articulate *chewink* of the northern towhee, was not heard.

I should add that, as before, three and sometimes four marsh hares were daily patrons of the lunch table, that the black snake and blue-tailed lizard still inhabited the log at my threshold, and the land-crabs solemnly proceeded with their various occupations from enlarging their burrows to plucking leaves. On the whole, therefore, I felt very much at home when, a week after my arrival, I settled myself for a winter's writing in these familiar and cheerful surroundings.

UPSET PLANS

Unfortunately, at this point my plans were seriously disturbed and it was February 2 before I returned to my bird blind. An acute attack of convalescence now claimed the greater part of my attention; what follows, therefore, is based on rather casual observations during the next three months. Meanwhile food had been distributed regularly and, as in the past year, there was no marked change in the composition of my bird group, and I found conditions in February very much as I had left them in December.

For a nature-lover whose sole occupation was to await a return of strength certainly no more favorable and enjoyable place could have been found than this retreat in the mangroves with its warmth and sunlight and bird companions. Day after day, idle but contented, I watched aimlessly, tirelessly, the cardinals, catbirds, and buntings,

the doves, hermit thrush, and yellow-throat who, in accepting my bounty, seemed to admit some special relation with me.

In color and character they made a varied company. The cardinals, spring's herald in the south, began to sing early in February, and thereafter the air resounded with their tender, musical notes. Seven different songs I recorded for the male at my doorstep, but this year I did not see the female sing. The fact that she takes a vocal part in courtship makes their wooing highly interesting, but so dense is the mangrove foliage that I saw little of what transpired within its walls.

The painted buntings are as colorful as they are silent. The female and male of the year are leaf-green; the adult male is as vivid as a trogon. Four or five of these birds fluttering in the sunlight and shadow over the feeding table make an enchanting kaleidoscopic display. One never tires of watching them.

The personality of a single catbird is sufficiently pronounced to have won him a high place in our ornithological annals. Imagine, then, the impression produced by half a dozen of his kind all within a few yards of you. One observes that there is never a moment when they are not conscious of every significant detail in their surroundings, be it of sight or sound. Their large, black eyes, clearly defined in their gray setting, express an alert, intelligent perception; their caudal gestures seem eloquent and appropriate; they are aware of your presence. In short, the catbird is good company. His nesting song has won him fame, and even at this winter season his voice deserves praise it has not received. It is a musical soliloquy, a harmonious, rambling, prolonged improvisation with no evident theme, but varied and most pleasing.

HERMIT THRUSH

At Gainesville, Florida, in January and March I have heard the hermit thrush sing a repressed song, but my single representative of that distinguished species at Little River uttered only its shoft *chut* call-note. Per-

Mockingbird



An Irregular Visitor

This mockingbird, which was the only one to visit Doctor Chapman's feeding station, was the resident of a dwelling distant two hundred yards or more and came only at irregular intervals for a drink and a meal of suet. It was not a gifted songster and did not imitate other birds



Marsh Rabbit and Cardinal

The association between birds and rabbits, illustrated on this and the following page, was one of the interesting developments of the feeding-table. Under natural conditions they would meet rarely, if at all, but their common interest in food brought them together, and the birds' normal fear of so large an animal soon disappeared

The marsh rabbits soon learned to eat chick-feed and often preempted most of the space at the dining table. A cardinal, however, is occupying a "seat" at one corner. The background of intertwined mangrove roots and branches afforded protection for the diners when alarmed



A marsh hare and catbird dine together. It was here that the rabbit was struck by a hawk from which, with the loss of some fur, it escaped. After two days of seclusion it reappeared at the feeding table apparently none the worse for the attack



haps it was not of the singing sex. In any event its gentle presence brought welcome memories of June vespers in the hemlocks. Always modest and retiring, the bird asked for no recognition of its high rank as America's first songster, and waited for others to finish before it took its share of seed or suet.

That masked midget, the yellow-throat, personification of restlessness, zigzagged its way through the maze of mangrove roots as though looking for something it could never find. But its presence was proof that it could find its way over the thousand miles or more that separated its summer and winter homes.

To these companions of the preceding year there were added two pairs of ground doves, exquisite little creatures, perfect in form, plume, and motion. With soft, questioning *coos*, on pattering pink feet they came eagerly but cautiously from the tangle of mangroves, their sleek, rounded heads and coral beaks nodding to and fro with each step, their wing-quills flicking nervously.

THE LADY OF SEVENTY-SEVENTH STREET

Recalling an incident of a double-decade ago, I decided to see if I could not strengthen my relations with these independent acceptors of my bounty. At the time to which I refer a lady of mature years daily fed the sparrows and pigeons that lived on the Seventy-seventh Street side of the American Museum. Carrying a large paper bag containing bits of dried bread, she scattered this food at certain places and at the same time uttered the usually ineffective whistle of her sex while the birds quickly gathered about her. "No doubt," I said to myself with the always superior air of the professional, as I frequently witnessed this pleasing scene, "the good lady believes that the birds are responding to her call, and does not realize that it is the conspicuously distributed food that attracts them." But one day, as I was passing one of her feeding stations, association prompted me to repeat her whistle, when, behold! pigeons and sparrows at once

came flocking about me in obvious expectation of food of which I had not a morsel. Nor could I believe that the birds were misled by any resemblance between me and their lady patron.

I trust that both as a man and a naturalist I profited by that experience. At any rate, it remained green in my memory, and I determined now to see if I could not create at least a phrase of language which the birds would understand. Every morning, therefore, while I distributed food, I whistled loudly a bar from the greater yellow-legs' call. It required thirty-seven days to establish the association between sound and food. Thereafter I could enter and remain within my little house and, by whistling, bring the still unseen birds from their seclusion before giving them their breakfast. To a limited extent, therefore, we became on speaking terms, and more than ever I seemed a member of their community.

Breakfast, I may add, consisted of oranges, intermediate chick-feed, suet, and water. Oranges supply both food and drink. They are taken freely by catbirds and mockers, less so by cardinals, and not at all by buntings and doves, who are strictly graminivorous. Grapefruit are almost as acceptable as oranges. Lemons are ignored when either of the other fruits are available, but are eaten very sparingly when offered alone.

In spite of the fact that the individuals of this little avian community occupied the same few square yards of earth and fed at the same table for more than four months, no intimacies developed between them. Omitting the ground doves, who were obviously mated, among the others, even of the same species, there seemed to have arisen no feeling of good-fellowship, or even recognition. The single individuals of hermit thrush and yellow-throat obviously passed the winter without contact with their kind.

TOLERATION AND LACK OF IT

The catbirds, cardinals, and buntings were more tolerant of other species than of their own. That is, a catbird and cardinal might

feed side by side, but never two cardinals (unless they were mated). This feeling of antagonism was aroused not alone by food competition but it appeared to be temperamental. Thus, for no apparent reason, two catbirds would suddenly engage in a claw to claw combat and flutter noisily upward through the vegetation. Even the undemonstrative buntings gave vent to these exhibitions of ill will and mounted into the air like slowly ascending, feathered fireworks. With them, and probably also with the catbirds, the actors were males, but both are winter residents, and their nesting season was too distant to attribute with certainty these manifestations to sex rivalry. But the combats of the resident male cardinals were evidently due to this cause. All three species, it should be observed, are not social in the sense that bob-whites and red-wings are. That is, they did not frequent the feeding stands in close-knit groups. But if the flocking impulse was lacking among them, they possessed sufficient communal spirit to come to their frequently taken meals together and to leave them together. Birds, therefore, were present or absent at more or less regularly alternating intervals. These were shorter in the morning, longer at mid-day, and with some approach to morning frequency in the late afternoon.

Hence, at 9 A. M., immediately after the first distribution of food, all the birds and three, rarely four, marsh rabbits came for what they doubtless considered an unpardonably late breakfast. Then followed an active period as the hungry birds eagerly fluttered about the food-table and the food on the ground beneath it or visited the suet-perches. If there was no alarm, false or real, they continued to feed until at the end of ten or fifteen minutes their hunger was appeased when, almost as one bird, they retired to the undergrowth to digest their rapidly eaten meal. If they had not been disturbed, twenty to thirty minutes might elapse before another bird was seen. If they had left before their meal was finished, they returned sooner. Thus, while there

was much variation in the times with which this program was observed, it nevertheless was followed with surprising unanimity.

Next to their mutually shared interest in food, the birds exhibited in common what one is tempted to call a sense of fear but which I believe may be more correctly designated a sense of caution. I cannot believe that any creatures could properly discharge the normal functions of their existence if they lived in constant fear of their lives. That they are shy and alert and never for a moment, when moving, off guard, is their normal mental attitude toward an environment in which, actually or potentially, danger is always present. Nevertheless, when, after a false alarm, the feeding bird returns to its interrupted meal within a minute or two, but after an actual attack is absent half an hour, it apparently exhibits the difference between the effects of false and real fright.

A HAWK APPEARS

During the first half of the present season the birds, as a whole, were far shyer than they were during the corresponding period of the preceding year. They were alarmed more easily and adhered more closely to the protection of the vegetation. Eventually it appeared that my daily distribution of food here had not alone made the place attractive for grain-eating birds, but that they in turn had made it attractive for bird-eating birds. In other words, a sharp-shinned hawk had found the hunting about my feeding stands so much better than in the country at large that he appeared to have made his headquarters in my vicinity. I had no gun and I am not sure that I should have used one. The sharp-shin is part of the picture that I wish to see as it was painted. He was born a carnivore just as the cardinal was born a grain-eater. Doubtless most of the birds he kills are below the standard of their kind and he functions, therefore, as an eliminator of the unfit. In this connection it is my duty to place no food where my guests will be unduly exposed when eating it.

The catbirds bathed at infrequent intervals; the other birds rarely entered the bath. Suet was their favorite food, while several tests showed that orange was preferred to grapefruit and that lemon was not taken if either orange or grapefruit were available. Although they had been closely associated for at



Catbirds

least five months and hence subjected to exactly the same influences of increasing light and temperature, the six catbirds present left for the north over a period of about two weeks (April 14-29). This variation shows an individual response to the causes that initiate migration, suggesting that they are; not wholly external



The result leaves me rather in sympathy with the sharp-shin! In spite of repeated attempts he has not, so far as I am aware, secured a single meal here. A female, or young male bunting feeding within a foot of cover, escaped a hawk's plunge with the loss of nearly half a tail, but this is the nearest approach to a bird tragedy that I witnessed this winter.

After his startling dash the hawk sat quietly for nearly a minute about a yard above the ground in a small bush fifteen feet from the blind. Perhaps he was "getting his breath." He was motionless, indicating that he had missed his aim, and when he quietly flew, this belief was confirmed by his empty claws and the five greenish tail-feathers I found beneath his perch. I wonder how often birds sacrifice their tails to save their lives?

A TEST

The sharp-shinned, and his large cousin Cooper's hawk, are apparently the chief enemies of small birds. From attack by these predators they are ever on guard. We have only to imagine ourselves constantly exposed to the aim of a sharp-shooter whose own life depends on taking ours, to realize the birds' need for vigilance; to understand why the catbird at my doorstep is so intensely alert before he relaxes long enough to take a bite of suet or splash in the bath. There is a reason, therefore, why they so often take alarm, and in response (usually) to the catbird's warning *cack-cack* dive into the denser growth.

To test the birds' recognition of the sharp-shin as a source of danger I placed a mounted specimen about nine feet from the ground in a small tree thirty feet from the feeding-table. It was concealed by a bunch of leaves, which, attached to a cord, I could lower from within my study. On every occasion when the hawk was thus exposed, a catbird gave the alarm note and all the birds that had been feeding on and about the table at once took wing. But when a mounted screech owl was used in repeating

this experiment, the birds paid no attention to it. This test, however, should be carried further before we assume that hawk and owl are actually distinguishable.

In view of the frequent occurrence of the sharp-shin in their vicinity it is not surprising, therefore, that my guests should have exhibited increased caution. In me, however, they showed added confidence and, as the season advanced, came freely to the feeding station while I sat within a few feet of it. Doubtless with due use of patience, which Mabel Osgood Wright has called the salt of the bird-catching legend, they could have been induced to feed from my hand. The marsh rabbits grew even tamer. I am by no means sure that they did not answer to my whistle in the morning; but possibly they may have heard, or even felt, my foot-step as I came to the blind. However this may be, they came with or even before the birds, and I attributed their comparative lack of fear to the apparent absence of enemies. The wild-cat of last year had not reappeared, and he, I assumed, was their only natural foe here. But at 3.15 on the afternoon of April 7 a hawk, probably a female Cooper's, struck a rabbit while it was feeding near the feeding-stand. With loud squeals and flying fur the animal struggled past the blind, bearing the bird on its back, and escaped beneath a dense growth of pandanus about twenty-five yards from where it was attacked. Here the hawk was unable to follow, and, as I looked from my door, it took wing through the low willows.

For the preceding week and a half three rabbits had been present daily. For the two days following, only two appeared, and I assumed that the one missing had been fatally wounded. But on the third day a third rabbit was present. He had a bare spot on his back, a mark, I believe, of the hawk's claw.

As the year advanced, the call of the nesting-season was answered by my guests in diverse ways. The ground doves now came alone, doubtless leaving their partner to take his or her turn on the nest. Their

A female cardinal,
with lowered crest,
dines alone



Three Cardinals



The cardinal's crest gives it unusual power to express its emotions. The male (center) registers alertness and suspicion as it approaches its meal of suet. The female (lower) is enjoying a sunbath and raises her plumage generally to permit the penetration of the sun's rays



Photograph of a barn owl made fifteen minutes after sunset with a 14-inch, F12.5 lens, wide open and an exposure of three seconds. The bird was born in the dead tree trunk on the top of which he is standing



A land-crab duel. The burrows of these animals dot the ground about the bird-blind. Although they fight fiercely among themselves, they do not attack the birds, and the birds show no fear of them



A red-headed (adult) blue-tailed skink and a black snake occupied a log at Doctor Chapman's doorstep, in 1933 and also in 1932. Neither of them showed any interest in the bird guests. The snake appeared irregularly and usually was bound for parts unknown

visits seemed to be made without regularity in time as regards sex. A male cardinal announced that this was his territory and pursued all trespassers. To others the call came from higher latitudes.

In writing of these northern migrants among last year's bird guests, I referred to the theory that attributes the date of their departure to an inner prompting connected with the annual return of the breeding season. If, therefore, as I surmised, my single yellow-throat and hermit thrush were the same individuals that were with me last year, it might be inferred that the development of their organic cycle would start them on their journey to the nesting ground at essentially the same time both years.

My records show that in 1933 the yellow-throat disappeared on March 25. This year he was not seen after the 24th. With increased interest I now watched my hermit thrush. Would he (I assume the sex) show equal regularity in the time of his departure. In 1933 he left me on March 29. This year he was present daily until the 30th. During that day he seemed exceptionally active. His periods of presence and absence were unquestionably shorter than usual. He seemed more alert. Was he feeling within him the stimulating influences that, without contact with his kind, were to send him on his way? However this may be, the following morning he had gone. Nor did I see him again. Here then was confirmation of my belief in the identity of yellow-throat and thrush with those of the preceding year, and support for the theory that the time of their departure for the nesting ground is an expression of the sexual phase of their organic cycle.

Whether, as has been suggested, the underlying influence that sends them on their journey is increased light due to lengthening days is open to question. The annual season of reproduction in birds is initiated under a wide variety of conditions. Light and heat decrease as well as increase, or they may not change perceptibly. In the tropics birds nest throughout the year, but apparently there is as much individual, seasonal regularity there as in latitudes where the date of the nesting season seems

to be governed by climate. On Barro Colorado Island, Panama, I found pairs and groups of birds nesting at the same time year after year.

Should we not, therefore, regard the enlargement of the gonads, marking the approach of the period of reproduction, as one of the several phenomena of the birds' physiological cycle, and attribute it to the cumulative influences of a past and present environment rather than to any one existing cause?

My catbird guests all occupied the same home during their five or six months' stay in the south, but, instead of leaving for the north at the same time, showed a variation of some weeks in the time of their departure, indicating a variable response to whatever factors are responsible for this phenomenon.

Before the cardinal has finished his sunset song, the young barn owl who, like his predecessor of last year, was born in the dead tree trunk above my blind, begins his food call; nor is his hunger appeased when the cardinal greets the rising sun. It must be confessed that his "peevish scream" is not a soothing sound, and there are occasions during the night when I should like to discipline this continuously vociferous owlet and his indulgent parents. But when I consider how his dreams are doubtless disturbed by the vibrant roar of distant motor cars, the hum of "blimps" and airplanes far and near, the unspeakably irritating racket of insignificant outboard motors, I feel that he, rather than I, has cause for complaint.

April 30.—The last catbird has gone, and it is time for me to follow him. We make essentially the same journey but what a difference in our methods! For days I have been packing books and manuscript, cameras and field-glasses, clothing for winter and for summer; and tomorrow I board a steamer, product of a Century of Progress, which, under the guidance of trained men, aided by chart, sextant and compass, will make its way northward. But the catbird, with no thought of ways and means, spreads his wings and flies into the night.

Spiders That Fish

by

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Readers of NATURAL HISTORY will remember, in former issues, two articles on spiders as fishermen and hunters contributed by Dr. E. W. Gudger of the American Museum; others by the same author have appeared in the Bulletin of the New York Zoological Society and Science Monthly. Mr. Meehean has now prepared the following article on the same subject, which is published with the permission of the U. S. Commissioner of Fisheries.

—THE EDITORS.

HAVE you ever seen a spider fisherman? Although his type might be found around any body of water in the South, he isn't as frequently observed as the more common kind. He lurks in the weeds and thickets, like the poacher he is, and fishes and devours his prey in seclusion.

Interesting observations have been made at the United States Fish Hatchery, near Tishomingo, Oklahoma, where the fingerling catfish are put into small rearing ponds. A little platform has been built out in each pond to which these fish come every morning and evening to be fed. At the sound of footsteps on the platform thousands of black bodies swarm and push one another as they rush forward eagerly. Their ungainly heads are thrust to the surface of the water, and hungry mouths protrude out of the upper film, with jaws working in eagerness for the dried skim milk or ground liver which they are to receive for their meal.

As the particles sink into the water, each one is surrounded by many broad faces nosing the morsel to break off pieces of suit-

In Which the Activities of Certain
Poachers of the Ponds Are Recorded

able size. Every lump of food is pushed around until it is gradually broken up and eaten; then the eager fish return for more.

It is at this time that native caution disappears as each individual zealously pursues the all-absorbing business of getting a satisfactory meal. Consequently he is not so wary and more easily falls prey to the less timid enemies. Or, in the early morning hours, when the pangs of hunger force him to forsake his murky hiding place under the thick growth of weeds or algæ covering the bottom of the pond, he seeks his food among the grasses in the shallow water and fails to notice the predators lurking on the stems of weeds or willow branches dipping into the water.

On one of his usual before-breakfast excursions around the ponds, Mr. H. C. Minch, hatchery foreman, found that an assassin had been loose among his charges. Many bodies were floating on the surface of the water. Some were partly eaten, with jaws missing or flesh stripped from the back. Others had a hole on either side of the backbone at the base of the skull. Many were mere wasted remnants of their former selves with only skin and bones left.

Mr. Minch noticed that a number of fish appeared weak and thin, later to become floating corpses. Each morning many would be found with the flesh stripped from the head and thicker portions of the back. The number of fish in the pond diminished as the carnage went on.

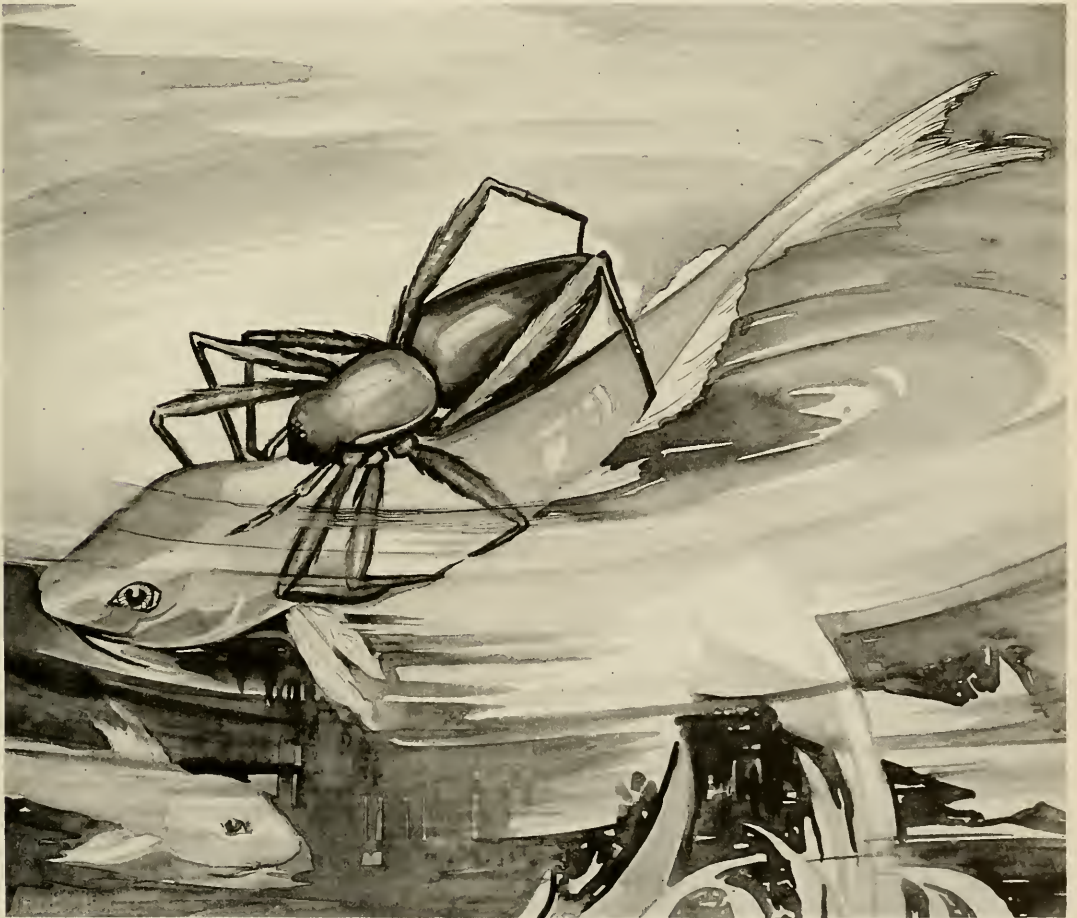
Finally, as the victims became scarcer and the raiders grew bolder, he made a discovery, one breakfast time, that solved the mystery surrounding the killing of the catfish and proved the undoing of the invaders. As the depleted ranks rushed warily and swiftly to the platform, the backs and noses began

to break water in a final dash for the dropping morsels. Suddenly a hairy shape dropped from the tall stems of grass and fastened itself to the back of one of the dusky feeders. There was a quick splash and all had disappeared except the victim. He lashed the water furiously as the attacker took a new hold around his body with four pairs of powerful legs and pressed his mandibles into the spinal column at the base of the brain.

A violent struggle took place. The catfish thrashed the water, and wiggled, and rubbed his back against the weeds and bottom in an effort to dislodge the spider.

Time after time he tried with supreme effort to get rid of his enemy by various means, but each trial was shorter and each rest grew longer. The spider took advantage of these rests by adjusting his legs for a tighter grip and sinking his mandibles deeper. After a few short convulsions followed by one or two weak tries, the victim relaxed as though under the influence of a drug.

The air entrapped among the hairs and under the legs of the spider made them buoyant enough so that he and his prey were brought to the surface of the water. As the spider broke free of the surface film,



Drawing by Hope Haupt

Poaching

“The catfish thrashed the water, and wiggled, and rubbed his back against the weeds and bottom in an effort to dislodge the spider”

he cautiously loosened the grip of his hind pairs of legs on the catfish and reached around for something to which to attach himself. Any movement of the fish, however weak, was sufficient to cause him to tighten his grip around the body.

Working his way over the surface of the water from weed to weed by pulling himself along with the two hind pairs of legs and with his mandibles still embedded in the victim, the spider was able to reach a cluster of weeds sufficiently large to hold his weight and near enough to the surface of the water so that he could devour his prey at leisure. At no time did the spider release his grip, so that there was no possibility of the fish breaking loose even if it had not been in a comatose condition. Although he was picked up in a dip net and transferred to a bottle of formalin, the spider persisted in keeping tight hold until the effect of the formalin made him let go.

Up to the time the struggle was observed there had been no clue as to the identity of the raiders. Later, a number of these spiders were found attached to weeds or grass close to the surface of the water, or with their victims pulled up on shore. Fish remains upon which the spiders had fed to a greater or lesser extent were observed along the banks.

The emaciated forms of catfish and half-eaten carcasses continued to float each morning until it was decided to get rid of the hiding places of these arachnids. This was accomplished by spraying the banks with gasoline to destroy all the spiders. The hiding places or footholds that they might find among the weeds and grasses which grew out in the shallow water were eliminated by alternately spraying with gasoline and burning around the edge of the water. This ended the attacks.

Specimens of the spiders sent to the American Museum of Natural History were identified by Mr. W. J. Gertsch as large females of *Dolomedes serripunctatus* (Hentz). He states that they are common throughout the region east of the Rocky

Mountains, and that there are three other species of *Dolomedes* reported from Oklahoma that are sufficiently powerful to kill fish.

Catfish up to two and three-eighths inches in length were killed by these spiders. Invariably, unless he had already started to devour the victim, the spider was found with the mandibles sunk in the prey at the base of the head and the legs claspings the body in a straddling position. Large females in my collection measure eleven-sixteenths of an inch. They are particularly tenacious and refuse to let go of their prey unless forced to, therefore they are easily captured.

The drawing used in connection with this article was made by Miss Hope Haupt of the Louisiana State Normal College at Natchitoches, Louisiana, and gives her conception of the attack. The spiders and catfish were drawn from actual specimens taken when the observations were made.

Since finding that spiders attack catfish, I have captured a small spider with a sunfish, *Helioperca incisor* (Cuvier and Valenciennes). These specimens were taken in a fish pond at the United States Hatchery at Natchitoches, Louisiana. The fish was still struggling when taken from the water. Actual observation of the attack was not made, since the pair were taken with a dip net in long grass overhanging the water.

Another spider was taken with a top minnow, *Gambusia patruelis* (Baird and Girard), in a bayou below Chaplin's Lake at Natchitoches. Although the fish was dead, the spider had not started to devour it. This capture was made in a thick growth of duckweed, in the process of seining for fresh-water shrimp with a dip net about two and one-half feet in diameter. In both instances nothing was added to the observations already made. However, they do seem to indicate that this type of thing is widespread, and that the spider is impartial as to the species taken and will attack any of the smaller fish that come near the surface of the water.

Patagonian Oasis

Even amid the wind-swept desolation of southern Argentine a haven may occasionally be found

by

George Gaylord Simpson

Leader of the
Scarritt Expeditions, and
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THERE are three Patagonias. One, and it is incomparably the largest, is a wilderness of ubiquitous pebbles, black lava flows, sterile volcanic ash, sparse thorn bushes, and eternal wind. It is a caricature of a country, a setting for antique melodrama, and in the words of the melodramas "it ain't fit fer man 'r beast." The second is so unlike this that it seems a misnomer to call it Patagonia at all. The narrow ridges of the cordillera, the glaciers of the southern Andes, and the wooded coast region of South Chile historically belong to Patagonia, too, but they are so unlike the pampa and meseta region in appearance, climate, and spirit that it is misleading to include them under the same name.

The third Patagonia is a saving grace in the midst of the first. Even in the wind-swept grimness of pampas, if there is soil and water, verdure may appear, and a welcome haven from the rigors of one of the most unattractive of the earth's corners may arise. Unfortunately the requisites of soil and water are very rare, and the green land forms such a small part of the Patagonian landscape that it is no more than a few scattered oases.

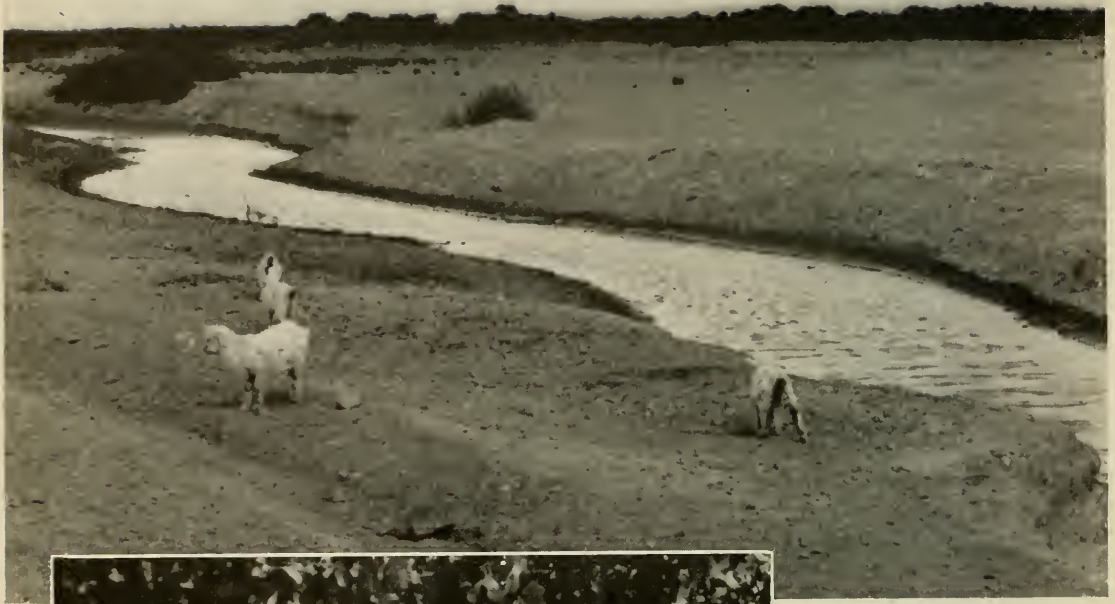
Look at a map of extreme southern South America. It will not be accurate, for even now there are large areas which have not been adequately explored or correctly mapped, but it will show the main features. In extreme northwestern Patagonia two streams, the Neuquén and the Limay, rise in the Andes; one flows south-eastward and the other northeastward, and they meet at the little settlement called Neuquén. The resulting river, the Río Negro, flows on through the meseta

region, barren even in this milder latitude, and into the sea near historic Carmen de Patagones, most southern town of Buenos Aires Province. The narrow valley of this river is the most northern Patagonian oasis.

For about three hundred miles south of the Río Negro there is no water except in occasional wells or desert springs. Then comes the Río Chubut, which also owes its continuous but fluctuating flow to headwaters in the distant mountains. Its middle course is near latitude 44° South (Portland, Maine, is nearly in latitude 44° North). The next permanent river, the Deseado, is nearly two hundred miles farther south at its nearest point, but between the two are the large lakes Musters and Colhué-Haupí, whose waters are also being utilized for the gradual development of a small oasis.

The region between the Río Negro and the Río Deseado is the most sterile and unpleasant part of Patagonia, a strong superlative, and the Chubut River flows nearly through the middle of this. Here in America it is hard to visualize what this means to the country and to travelers in that distant land. I sit here looking out at green grass, leafy trees, busy streets, tall buildings, and it is an effort to recall the thrilling joy, the real rapture, that I have felt at seeing a muddy stream, a few poplars, and a rather forlorn little frontier town.

The first time I saw the Chubut Valley,



Above:—Goat country. Where cattle cannot live the settlers raise sheep. In country too poor even to support sheep, goats are the last resort. Such scenes as this show that even water cannot create an oasis in Patagonia without the further requisites of good soil and human labor

A gaucho. The traditional costume is now rarely seen. A few old conservatives still use it, but otherwise it is only donned for celebrations. With its lace pants and voluminous chiripá, the costume looks effeminate, but its wearers are at least as tough as their American counterparts, the old-time cowboys



Above:—The Chubut Valley is a main artery of traffic and much of the wool from the cordillera passes over this route to Trelew or on to the coast



Right:—A ferry across the Rio Negro

Below:—Sheep raising is one of Patagonia's principal industries and, consequently, wool one of its major exports



my party and I had been wandering and working in central Patagonia for seven months. Work done, we turned northward with relief, but so deadened by the wind, harsh living conditions, hard work, and a repugnant environment that we could not really visualize anything else or believe that release was near. From Comodoro Rivadavia, the largest town of Patagonia but a desolate, treeless, corrugated iron place, we traveled for three days. Constant mishaps delayed us, but we were used to them.

AN UNBELIEVABLE VALLEY

On the third day, toward sunset, we were driving across the nearly flat and wholly drab pampa beneath flame-colored, wind shredded clouds. In the last hundred miles we had passed just one house, a small square box of mud and tin. Everywhere else were pebbles and thorn bushes, with only an occasional guanaco or hare to give life to this monotonous and desert plain.

Unexpectedly we came to a jumping-off place, sudden cliffs and steep slopes down to a flat-bottomed valley. Straight ahead in the valley was a spot that represented the Territorial Capital, Rawson, and somewhat nearer, to the left, was a more distinct cluster of houses beneath two tall radio towers, the town of Trelew, metropolis of the oasis. We went down into the valley, and life became a strange dream. We seemed to be driving along a country lane, between rows of green trees, and over rustic bridges across placid canals and streams. We seemed to pass farm houses and green fields and to see cows wandering homeward to be milked, escorted by white and blonde children. Surely it could not be real!

Since that memorable moment, I have spent some time in the valley, in most of its various small settlements, and have traveled along the better part of the river course, from Trelew to Paso de los Indios. I have learned that even the valley has its barren and truly Patagonian stretches and

that the best of it is not the paradise it seemed on first sight, but the exhilaration of that first shock will always make it stand out in memory.

On that first visit we stayed only two nights in Trelew, but somewhat more than two years later we were there again, and became better acquainted. This time we came in from the north, or northwest, and although we were only beginning our work instead of ending it as before, the valley was almost equally welcome. We had been traveling for three weeks, as steadily as circumstances permitted, and we had had lots of luck, all very bad: few or no fossils, which we had hoped to find, continual breakdowns, a nearly tragic slip-up in financial arrangements, illness. Such is still the common lot of the traveler in Patagonia, and we had been far off the beaten path, such "beaten paths" as there are. In one place where motor car never went before and never should again, after mishaps that exhausted our supplies, we came gently to rest with a broken crankcase in a howling wilderness of jagged lava blocks, and stayed there, foodless and waterless, until a repair was effected with some household cement and an old shirt. The Chubut Valley looked good to us then, too.

METROPOLIS

Trelew is wonderful only when seen in its vast setting. It looks like most Argentine country towns, but this conformity is itself a triumph and almost unique in Patagonia. The straight streets, laid out at right angles, are wide, and some of them are lined with small plane trees, not flourishing but accomplishing the miracle of survival. The avenue from the railroad station is a boulevard for two blocks, with a coarse grass plot in the center. Most of the buildings are stucco, one story high except for the national bank and the main hotel, which rise in grandeur above the flat town. There is a plaza, ragged but green in summer. There are good stores and

large corrugated iron warehouses. There is a Colegio Nacional, national high school, which enjoys a reputation as one of the best educational institutions in the country. There is a private school where instruction is in English and which struggles to keep the children of British and American settlers throughout Patagonia from forgetting their ancestral tongue. There is a three-story hotel with running cold and (for a trifling extra fee) hot water. A catalogue of the wonders of the metropolis would be endless. New York is not as remarkable in its environment as Trelew is in its.

A PATAGONIAN WALES

Rawson, Trelew, Gaiman, and Dolavon are strange names for Argentine towns. Then there is the place, farther up the river, which the natives call Blahk Aý-zheh, and which is spelled Black Eye. And around Trelew are places with such names as Bryn Gwyn, Drafa Dulog, and Bryn Crwn. The oasis is partly inhabited, and was indeed largely created, by people of Welsh descent. About 1865 a group of Welsh people, dissatisfied with economic conditions and (it is said) nursing a hearty grudge against their neighbors and masters the English, emigrated to the Argentine and were given the Chubut Valley to live in, generosity somewhat tempered by the fact that the valley was then barren and generally considered worthless. They turned to with the idea of creating a new Wales, where language, customs, religion, and life in general were to be purely and exclusively Welsh. With pick and shovel they dug ditches and irrigated the alluvial flats of the Río Chubut with water from the river. Along the ditches and around the fields they planted poplars, now large and imposing. A railway was built from Gaiman and Trelew to the sea at Puerto Madryn. (It has now been extended up the valley to a point near Las Plumas.)

The idea of isolation and a new Wales did not work as expected; such ideas

seldom do work out. There is still a distinctly Welsh atmosphere in much of the lower valley. Welsh faces are seen on every side, and the Welsh language is still spoken, but to the distress of the elders, the third and fourth generations, now appearing, tend more and more to be absorbed into the Argentine population. Spanish is the common language of the valley, and much of the best land and most profitable business is no longer in Welsh hands. The descendants of the pioneers have lost their spirit. They are not, as a class, particularly industrious or progressive, and the Welsh Colony cannot now be called flourishing. Such progress as now occurs is only in small part due to them.

The best part of the valley is the stretch of some twenty-five miles around Trelew and Gaiman, a smaller town about twelve miles from Trelew. The valley bottom here is from three to five miles wide and most of it is irrigated and fertile. There are probably at least forty thousand acres of useful land (the figure is my own guess, and I am sorry to say that I have not checked it with the official estimate). With varying degrees of comfort, this supports a population of several thousand people. The value of the oasis is clear from the fact that the same amount of land away from the river in this region would support about three families.

OASIS AND DESERT

The contrast is amazing. There is this narrow band of arable land, a bare hair-line on the map of Patagonia, and then at its edges, with no transition, begins a howling desert. Two minutes' walk from Trelew or Gaiman, on the northern side of the valley, is enough to pass from pleasant country scenes to a dry land of pebbles, sand, and thorns. The steep valley walls rise abruptly from the river bottom. They are in most places absolutely barren cliffs and slopes of dazzling volcanic ash, slippery clay, or glistening gypsum.

The value of change is amusingly illus-

Town and



The town of Trelew has wide streets, rows of small trees, and many modern improvements which the visitor is quite willing to appreciate, for, in order to reach this metropolis of the Chubut Valley, the traveler must cross an unbelievably harsh and arid region. For Patagonia, Trelew is a delightful place, but even here the wind is almost incessant. There are, naturally, few traffic jams, but the town contains a few modern buildings such as the Bank of the Nation shown below



Country

Architecture in the Chubut Valley leaves something to be desired. The Indian hut at the right is built of mud-plastered sticks and it blends into the landscape so perfectly that from a distance it is almost invisible. The two huts shown below, one covered with flattened kerosene tins, and the other built of sticks and mud, are quite typical of the region. Structures more elaborate than these are very rare indeed outside the towns, and even in town such hovels as these are common



trated by the fact that when the citizens of fortunate Trelew take an afternoon off for a picnic, they do not as a rule go to some shady grove along the river. The favorite picnic ground is a place called "El Castillo," "The Castle," a round hill with castellated, in places vertical, sides, which is on the desert side of the valley margin and hence a desolate spot for an outing. This locality, incidentally, has more serious claims to fame than as a picnic site for the élite of Trelew. From its own slopes and those of the main valley wall near it have come many remains of fossil whales of the early Miocene, some twenty-five or thirty million years old.

THE OYSTERS OF PATAGONIA

It is one of the many anomalies of Patagonia that not only here, but still farther from the sea, still higher in elevation, and in still drier parts of the desert are found remains of whales, of penguins, and of many kinds of sea shells. Over almost all of what are now the high plateaus of this region the sea once roared. It is ironic and maddening to be traveling through the hinterland, parched and hungry, with "water, water—" nowhere, or perhaps only a few tepid drops in a tin canteen to drink, and to come across the shells of oysters a foot in diameter. How one's mouth waters! One oyster, just one, would be a succulent feast for a king. But it is no use. As Mark Twain would say, they are dead now. One could almost curse the name of Hatcher, the great American explorer, for whom these now long-defunct oyster dinners are named.

We camped near the Castillo for a time in 1933, if it can be called camping to stay in a house and be fed by an excellent Italian cook.

Our next camp in the valley was even more luxurious and will still further explain my unbridled enthusiasm for the Patagonian Oasis. We stayed across the river from Gaiman on a fruit farm run by a man nominally Argentine, since he was born in that country, but in speech, ap-

pearance, and habits more American than I. His wife is American and his children technically Argentine, although his charming small daughter has been infected at the English school in Trelew with the almost virulent exaggerated Anglicism of the expatriate English. They have a modern and pleasant house, where we reveled in real luxury and could almost imagine ourselves back home. Our host had acquired some of the old run-down orchards left by the early settlers, had incorporated himself to acquire capital, and as the company "La Araucana" was engaged in reviving and renovating the place and establishing a business in fine apples and other temperate zone fruits, many of which grow very well here in the oasis. The most difficult problem, that of reaching an adequate market, is still acute, but this exemplifies the very good best that can be done in the valley with energy and initiative.

A RAILROAD WITHOUT FREIGHT

This part of the valley owes its importance not only to the development of its own resources but also to the fact that it is an important avenue of commerce and outlet to the sea. Through it passes the wool from the scattered sheep ranches of the barren interior and the richer zone of the distant cordillera. The railway, recently completed to near Las Plumas, about one hundred twenty miles (in a straight line) from Madryn, the port, has considerable influence in this, but less than it should have. In the endeavor to increase its scanty revenue, the freight charges have been made so high that many shippers find that it still pays to take the wool to Trelew or on to Madryn on wagons in the time-honored way. The economic principles involved seem a little confused to a mere scientist when he sees a perfectly good railway apparently going to pieces for lack of trade, and enormous amounts of ideal freight for it hauled for days parallel to the tracks on primitive carts drawn by horses and mules.

Above Gaiman, the valley narrows and becomes less fertile and less accessible. The main wagon track to the interior and the more winding railway track climb up on to the pampa north of the valley and across the dreaded "travesía," a stretch of about seventy-five miles with no water and almost no inhabitants even now. From this more typically Patagonian desolation, the road plunges down again into the valley at Las Plumas. As if afraid to wet its feet, or in haughty scorn of the valley dwellers, the railroad stops on the heights. It is proposed some day to continue the line back to the cordillera, and there is even a dream of linking it up with the more northern lines so that one will be able to ride on trains from Buenos Aires to Trelew. But that will be *mañana*.

Las Plumas is a quiet town with none of the bustle of Trelew, where I have seen as many as three automobiles in one block. Having all outdoors to build in, they have not bothered about streets and have put up the four or five buildings scattered around irregularly several hundred yards from one another. We stopped at the hotel, which tastefully combines sticks, mud, flattened tin cans, and corrugated iron in its architecture (the Chubutian Order), and as the wind howled and everything portable for several leagues to windward was rattled and banged on the tin roof, we knew that we had definitely left the oasis.

DANGERS OF THE ROAD

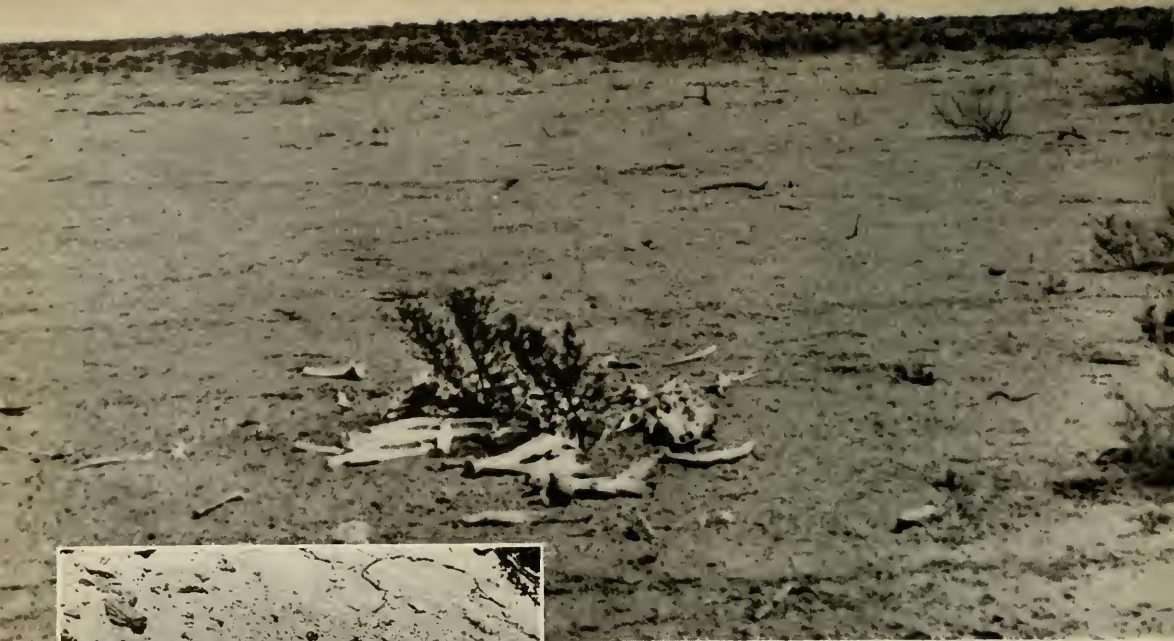
We spent one night, and then were barged across the narrow but unfordably deep stream. On the other side there are two roads. One climbs out of the valley and runs over the waterless pampa for a hundred miles, more or less, to Paso de los Indios. The other stays down in the valley and follows the river. The outer track is a little longer and is feared because a breakdown on it may mean, and has meant for some luckless souls, death by starvation or thirst, but as a road it is much better.

In spite of its terrors, most of the carters, all fatalists and gamblers at heart, follow it. The track along the valley is hardly less desolate, and is so rough, rock strewn, eroded, and generally nasty as to be nearly impassable at all times and often completely so, but it is shorter and it has water.

A LAND OF GRANDEUR

We were saved from any emotional conflict over this choice by the fact that fossil-bearing strata had been reported in the valley, and we had to go that way to check up on them. The report was false, and we cursed all lying geologists as we banged and groveled our way along the unspeakable wagon trail. We did not get stuck. The capriciousness of travel is one of its chief charms and, at the same time, annoyances. How many times have we started off gaily for what promised to be a gentle joy-ride, and found ourselves at midnight deep in fetid mud, or mournfully attempting to patch up some mortal wound to our fickle mechanical beast of burden! This time we had departed sadly, hiding the quaver in our voices as we bade good-bye to the prophets of our doom, determined to die for the honor of bone-digging (if it has any honor), and everything went smoothly and we arrived at our next destination in one short day.

Furthermore, the difficulty of the track was more than amply compensated by the grandest scenery I have seen in South America, with the possible exceptions of Mount Aconcagua from the air and of the harbor at Río. If this valley were in Europe, every rock would have its legend and we would have known of its renown while still in our cradles. If it were in the United States, it would be a national park and, while they were not busy eating hot-dogs, thousands of sunburned tourists in knickers too small for them would express the nearest to rapture that their measly souls can attain by saying "Sorta pretty, ain't it?" As they are in Patagonia, naturally no one ever heard of the Valley of Martyrs ("Valle



Above:—Desolation. By far the major portion of Patagonia is like this



Left:—Giant fossil oysters now found on the arid margins of Chubut Valley

Desert

Below:—This picture was taken less than a mile from the river, yet every movement of the horses raised clouds of volcanic ashes





Above:—The lower valley of the Chubut near Trelew seems amazingly beautiful amidst the desolation of Patagonia

and Oasis

Right:—Near the Chubut River in one of Patagonia's most extraordinarily beautiful regions

Below:—The Chubut River near Trelew wanders placidly among the wind-tossed poplars but the desolate pampas are not far away





Above:—In the upper Chubut Valley, even the presence of water is not always enough to create an oasis



Left:—Away from the few streams and lakes spots of verdure such as this are very rare

Below:—Between the river valleys the vast expanse of Patagonia is a sterile region of black lava and white volcanic ash



de los Mártires"), the Valley of Ruins ("Valle de las Ruinas") and the Altars ("los Altares"). Being unknown, however, has at least the advantages that there are no tourists and that we can enjoy the smug satisfaction of believing ourselves the only people in North America who have ever seen that sight, or are very likely to see it.

There are enormous cliffs, often really vertical (it would surprise the average sight-seer to know how seldom a cliff is actually vertical), and composed of pure variegated porphyry. There are caves in which a regiment could hide. There are peaks and pillars, prows of ships, Gargantuan monuments, strange statues, all carved by wind and weather from rock which sometimes here seems "living rock" indeed. There are seeming ruins in the shadow of which the greatest structures of Egypt or of Greece would be lost. There are horizontally-banded, fantastic flutings of white, yellow, blue, and red. There are the "altars," each a hundred feet high and seemingly attended by frozen priests of nearly equal stature.

DESERT CAÑONS

Through this scene winds the Río Chubut, in varying lights a silver cord, a river of fire, or a dun-colored highway. In places strange natural forces of the Glacial Epoch have caused it to abandon a gorge already hewn from the solid porphyry and follow a new channel of equal grandeur, and here the scene seems more strange than ever, for these cañons without the accompanying stream are impressively queer and seem ominously dead.

Words and space are lacking to describe these things. And, too, they are beyond the oasis of which I have written. Their bearing on the oasis is simply that this is the same river, and this valley a continuation of "the Valley," and yet there is

only this desolate and nearly lifeless grandeur. There are a few Indian huts with some goats scrabbling for an existence near by. In the few better spots there are even sheep herders' huts. Here and there a valley flat has a little grass or perhaps a few willows, so buffeted by gales that they grow eastward almost horizontally. But these valleys and gorges are savage and they are not under the human yoke as is the subjugated valley of the oasis.

THE DESERTED INN

Not far from Paso de los Indios, the point where the river coming from the north turns eastward in its course to the sea, there is an inn. It was built in hopes that wool-carters would pass this way, and was tritely but accurately called *Bella Vista* ("Beautiful View"). The carters do not now pass this way, and the innkeeper has so little optimism that he does not bother to stay there very much. We found the place open but deserted, so moved in, uninvited, according to free Patagonian custom. A shepherd saw us from a distance and relayed the news of this miracle to the absent innkeeper, so that he arrived in time to try to take advantage of our custom to get enough money to move to some more prosperous point. The difference between an inn and a house is often reduced to the technical point that at an inn the owner feels free to charge (and often to overcharge) for accommodations.

After dooming this ambitious man to wait there for another miracle before he can afford to migrate, we went on the next day to Paso de los Indios (which makes one long for the cosmopolitanism of *Las Plumas*), and then left the river and its valley and plunged into the unmapped and wild heart of Chubut Territory, where, as the old mariners were wont to say, we passed divers grievous adventures.

Beaver

by

Lucie and Wendell Chapman

Photographs by Wendell Chapman

OUR beaver population is increasing. Last season the state of Pennsylvania provided trapping for the first time in many decades. After beaver had been destroyed in that state, two were imported in 1917 and subsequently forty-six pairs were brought in. By 1933 the numbers had grown to approximately 15,000, according to the Pennsylvania Board of Game Commissioners. Similar success has been attained elsewhere as well.

With a revival in the beaver numbers, the vacationist now often sees near at hand that mysterious animal which lured the trapper into the wildest and most remote sections of the country long before gold beckoned to the prospector. Fishermen today frequently see beaver swimming in ponds or streams, diving to the bottom for underwater plants, or crawling on to the banks to eat, preen, or repair houses or dams. The trapper is being allowed to take the surplus numbers of this valuable fur bearer to increase his income.

Our country is fortunate to have the beaver's existence assured, because he is a friend to many, a detriment to few, and an enemy to none. The pioneers recognized only his valuable fur, but people now are learning of his other values. His ponds provide excellent breeding grounds for fish, water fowl, muskrats, otter, and mink, and afford succulent underwater plants required by the moose. The beaver does no harm to any of these neighbors. In addition, his dams catch fine silt which would otherwise wash down the streams and rivers. When the food supply of one district is exhausted, the beaver abandons the ponds. After they are deserted, they still check

The original exploration of the American West was performed largely by trappers bent on taking beaver skins. Almost exterminated by this uncontrolled trapping, they are now growing more numerous, and are again demonstrating their value as agents of conservation

flood waters: the thick deposits of finest silt absorb and hold moisture and eventually become the richest of meadows for grazing animals or garden spots for the farmer. Not only is the immediate country benefited, but the country down stream is also benefited through the checking of flood water and its gradual release into the streams. So far-reaching is the value of the many small dams along a watercourse, that the government is employing some of its emergency workers to establish check dams. In the Black Hills of South Dakota, where beaver have been trapped out and denudation is a serious problem, the government is building small beaver-like dams. But without constant attention, such as the beaver gives, these efforts cannot succeed in holding back soil and water.

In return for his many benefits, the beaver takes little. He sometimes floods roads or fields and he cuts down trees. Mr. Vernon Bailey, of the Biological Survey, has found a method of inserting a drainage pipe into the dam which effectively holds the water at any desired level in spite of the efforts of the beaver. He has also invented a live trap so that the beaver may be caught unharmed and moved to other districts. The trees which the beaver cuts are usually of little or no commercial value. In the West the beaver prefers quaking aspen trees, cottonwoods, and willows, none of which are of commercial use. He cuts few evergreens even if they are abundant. Usually one or two small ones each season suffice for a family. Seemingly they are used as a tonic. When the soft wood deciduous trees and willows are gone, the beaver usually moves elsewhere.

In addition to the indirect aid to fisher-



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AT WORK

This old beaver was very efficient at his work, but at this point the notch that he was cutting proved to be too narrow and had to be widened. On the following page are pictures showing the stages that preceded this



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Having removed this lighter branch, the beaver turned his attention to the heavier section of the tree, as is shown in the photograph below and the one on the preceding page

Starting the notch. Note that a single long chip is being removed in one piece, the beaver having cut it loose at the ends and chiseled it out by progressive strokes of his long lower teeth

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The desire of a beaver to cut a limb off flush with the trunk sometimes causes him to stretch three feet or more to do his work

Because he cuts with his lower incisors only, the beaver turns his head nearly upside down to cut the upper face of a notch in a standing tree

© Wendell Chapman

Small branches are cut diagonally by a few progressive strokes of the lower teeth

© Wendell Chapman



men, hunters, and agriculturists, and in addition to the value of his fur, this animal has played an important rôle in American history. So important was he in the early days of the West that his pelt was the medium of exchange. All commodities, including other furs, were valued in beaver hides, which were packed like currency in bundles of sixty to a hundred skins. It was the quest of his pelt which opened the West.

For the nature lover the beaver has interest and inspiration. His communal life, coöperative efforts, and his harmonious social system are as exemplary as those of the ants and bees. But he accomplishes his social unity without making slaves of most of his population and distorting the vast majority from normal individuals into workers, as do the insects.

A FRIENDLY COLONY

One autumn we came upon a colony of beaver hard at work cutting and storing food for winter, and were accepted by them as friends. For two months we watched them daily. On several occasions they touched us with their paws or noses, crawled over our feet, wetting our shoes with water dripping from their coats. Frequently they turned their backs to us while working, their paddle-shaped tails resting at our feet.

The largest beaver of the colony was the leader. Leadership, in so far as we could determine, was a matter of self-sacrificing obligation based upon capability. Every evening before the night's work began, this old beaver was the first to leave the lodge and to reconnoiter around the pond in search of enemies. If he observed unfavorable signs, he returned to the lodge and did not reappear for an hour or more. If an intruder was causing a disturbance, the beaver whacked the water with his tail before diving. If the intruder was quiet, he dived silently. If all was well, he went on land to the aspen grove. Being larger and stronger than the rest, he did more work and faced more dangers. The labor and capital, production and distri-

bution of the beaver present no social problems. Each individual joyously does all he can to build and store for winter. Once the food is stored, it is community property, and everyone is entitled to all he desires so long as any food remains.

Good citizenship on the part of the beaver is largely a result of his eagerness to work. Nature has made it imperative that each beaver labor or starve. He cannot live idly. His incisor teeth grow rapidly to offset the tremendous wear in cutting his wood for food and structures. Whether or not he works, his teeth keep growing, and if long left idle, they might grow out and pry his mouth open, so he could no longer eat. He can keep the growth down chiseling the teeth together as he does in sharpening them, but a substantial amount of gnawing is needed to keep them normal. We examined a beaver skeleton illustrating this. A shot had broken the lower jaw, throwing it out of line so the upper and lower pairs of incisors did not meet. The beaver was therefore unable to cut and the uncurbed growth of the incisors finally barred his mouth, causing him to starve, although his jaw had completely healed. To prevent a similar fate the normal beaver gnaws dry poles during the spring and summer when he cuts no trees for storage, and few for food. Often on his vacation trips he cuts dead wood for no apparent reason, except to keep his teeth in order. And so we see that the beaver, irrespective of whether or not he becomes leader of the colony, labors according to his ability. His position seemingly is not one of honor, it is merely one of responsibility and risk.

BEAVER FOOD

Each evening after seeing that all was well around the pond, the old beaver devoted half an hour to his "breakfast." If he found the aspen branch we had dragged to the water's edge, he would tow it to one of his several dining seats. These were stumps or logs half a foot under

water, on which he sat. Before the frost had parched the leaves, he grabbed them with both hands, shoving them into his mouth with open palms, like a human baby feeding itself, and smacking loudly. Twigs up to the diameter of a lead pencil he grasped with one end in each paw, bent them double, and fed them with mechanical steadiness into his planing mill teeth. His lower jaws, working at the rate of five or six strokes per second, shaved the stems into thin flakes. Upon accumulating a mouthful, he paused to masticate the "corn flakes," alternating his lower jaw first to one side then to the other in chewing. Branches larger than a lead pencil in diameter he peeled with the same rapid motion of the lower jaw. He held the sticks with hands bent up at the wrists, flaking the bark neatly from one end, sliding the stick along, and turning it as he ate. When eating from these small sticks the beaver looked like a flute player. Sections of tree trunk which were too large to hold were grounded in shallow water or against the storage pile and the bark chiseled off. If a log still contained bark after the meal was finished, it was anchored in the storage pile.

Peeled sticks were sometimes taken immediately to the roof of the lodge and converted into "shingles," but usually they were abandoned until the beaver or some of his clan felt inclined to work on the roof.

The meal finished, the beaver swam around the storage pile, re-anchoring any loosened pieces, whereupon he left for the harvest field.

DIVISION OF LABOR

A half hour or more after the old beaver left the lodge, others came out at intervals, evidently assuming that all was well if he did not return. No news was good news. After dining, each adult beaver went to join in harvesting. As soon as a tree was felled, several helped in cutting and hauling, although a single beaver usually felled the tree.

Trips on to the land were made hesitatingly by the first beaver, because of the possibility of the presence of coyotes and bears. But once he was working and could be heard by the others, they waddled confidently up the runway. Immature beaver seldom ventured far on land. But when trees were felled close to the pond, they went to help. Sometimes the older beaver piled branches at the water's edge, which the small beaver eagerly towed to storage.

HOW A TREE IS FELLED

Before cutting a standing tree, the beaver seemed to consider only two things: first, to find a comfortable place in which to sit or stand; and second, to locate the most tender part of the bark within reach.

The beaver turns his head nearly upside down to cut the upper face of a notch in a standing tree, because he cuts with his lower incisors only. The upper jaw is rigid and used for holding, the upper teeth at most merely marking the bark. We observed many times that the lower incisors did all the cutting. Examination of any recent beaver cutting will clearly bear out this fact. Each double-grooved tooth mark blends out at the end of the stroke as gradually as it blends in at the beginning. If both pairs of teeth shared in the cutting, there would be a perceptible seam where the two pairs of cutting teeth meet. When felling a tree or cutting it up for storage, the beaver cuts at about half the rate of the eating stroke. His working speed is from two to three jaw strokes per second.

If chips lodge behind the incisors and balance in the mouth, the beaver usually flips them out with his paws and not with his tongue. The reason for this apparently unnatural act is that the tongue rests under fur-lined lips, which pucker in above the toothless portion of the gums behind the incisors. These fur flaps keep the mouth effectively closed even when the jaws are opened for cutting. Such sealing of the mouth permits the beaver to cut under



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Above:—He can twist about very easily, even to the point of brushing his back. Occasionally, in his preening, he pauses to remove a leech



Left:—The beaver's personal habits are exemplary, and he is given to spending more than a little time grooming his coat

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Below:—The top of his head gets a little attention. Fond of preening as they were, however, those observed by Doctor and Mrs. Chapman never preened each other

© Wendell Chapman



Right:—Eating small twigs. Everything they eat is first shaved into "corn flakes"



© Wendell Chapman

Right:—He is likely to strip every chip of its bark



© Wendell Chapman



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In the circle:—When eating from small sticks the beaver bears a humorous resemblance to a flute player

Below:—Sentinel pose. The hind, webbed foot has a small toe on the outside, next to which is the main toe. The thumbless forepaws are very dainty

© Wendell Chapman



cold water without exposing the mucous membranes of the mouth and throat.

When the tree comes crashing down, the beaver runs to the pond regardless of the direction in which the tree is falling. Undoubtedly, tree-felling is very dangerous when the trees are a foot or more in diameter. But trees which are six to eight inches in diameter are less hazardous than might be supposed. By the time they descend, the beaver is well on his way and beyond the point where the heavy trunks will fall. He is out where the fluffy branches cushion the impact, and unless a limb breaks off and gouges him, his sturdy body will withstand the blow even if the tree top descends upon him. Once we saw a tree nine inches in diameter fall on a beaver without injuring him.

FOOD SUPPLIES

After several minutes of watching and listening, the beaver returns to the fallen tree. Quickly cutting off enough branches for a load to take to storage, he departs. A load may be anything from one limb to half a dozen small branches. Usually he completes the trip to storage without interruption, but occasionally he drags the branches only as far as the water's edge before returning to the tree for more.

When gathering a load of small branches, the beaver trims off three or four, piling them to one side. When he has cut off all his mouth will grasp, he gathers up the branches with his forepaws and places them behind his incisors. When but two branches are sufficient for a load, he holds the first one in his mouth while he cuts the second. Once we observed a beaver attempt to cut a second branch while holding another so large it interfered. With one forepaw he grasped the first branch, removed it from his mouth, held it resting on his other forearm, cut off the second branch, and then adjusted both in his mouth for hauling.

Twigs and branches up to half an inch in diameter are cut off diagonally with a single stroke of the incisors. Those from

half an inch to about an inch and a half in diameter, are cut off on the diagonal by three or four progressive strokes, the lower incisors making the entire cuts. Larger limbs are notched, the beaver turning his head to cut the notch on either side, and then chiseling the wedge out before attempting to remove it. These notches vary from two to seven or eight inches in width when started.

The larger end of a cutting is held in the mouth as the beaver drags it down the runway or tows it through the water. The beaver usually carries limbs or branches stem end first. Projecting limbs and branches which point backward offer much less resistance than if the limb were towed small end first, in which case the branches would stick forward and catch readily on brush down the runway or would offer more resistance to towing through the water. When the load needs to be adjusted or shifted to the opposite side of the mouth, the beaver, if on land, grasps the branch with forepaws and hoists it overhead; if in the water, he may make the shift in the same manner or he may let go and dive under to the opposite side.

MOVING THE LOGS

When cutting off limbs or when cutting a tree trunk into sections, the beaver usually takes time to eat the green bark from the largest chips. Unless fear of enemies keeps him away, he invariably returns to the scene of the felled tree, picks up and sniffs at all the chips, and strips them of their bark.

Heavy limbs or log sections often lodge, while being dragged to the pond. When this happens, the beaver braces his teeth and forepaws against the aspen and shoves forward and upward with tremendous strength. If it is a log which lodges, the beaver sniffs carefully for projecting limb stubs, which he cuts off flush before trying to move the piece.

The beaver shakes himself like a dog as he crawls out on the shore, flipping the

water from his outer coat and fluffing it up into paintbrush tips from which additional water drips. Frequently he takes time out for a most careful toilet. Sitting on the land, he rubs his cheeks against the lay of the fur, giving himself a most ludicrously fierce appearance. Then, with forepaws pressing his fur and swiping outward in unison, he preens his chest, working down to his stomach and sides in overlapping swaths, reaching around each side as far as his short arms will permit. Twisting around, he brushes his back, occasionally removing a leech. Dropping down on all fours, he uses first one hind foot with the split toe nalis, then the other, to comb his sides in deliberate strokes resembling the shaft of a boat wheel in movement. On the first and second toe from the inside of the foot the nails are double, the upper portion being loose and fitting down over the lower. The upper nail opens much like a parrot's beak, and is of advantage in combing.

Preening fluffs up the fur and presses out the water. Except for the removal of an occasional leech, the beaver we observed rarely directed attention to one spot with that avid interest so characteristic of monkeys. Judging from the calm, even preening of these beaver, they were not inhabited.

PREPARING FOR WINTER

With the approach of winter, the beaver puts the lodge in good repair. Both the lodge and dam are examples of the beaver's weaving. Sticks and poles are shoved endwise into the growing structure with no plan or pattern, except that each added stick is poked somewhere.

Towing old poles through the water, often having gone on land to get them, the beaver crawls on to the lodge, walking upright with insecure footing. Occasionally he steps into a hole and grounds astride a stick or pole, in which event he waves his webbed foot around for another grasp. When he finds new footing, he con-

tinues his uncertain ascent. Arriving near the top of the lodge, he proceeds to poke the pole into a crevice, so long as it will move. One evening we saw a beaver hoist a very long pole on to a house. Shoving it into a hole, he kept poking it along until it stuck out beyond the opposite side and above the house, finally tipping into the water. As the pole failed to lodge, the beaver simply shoved it up one side of the house and down the other. By the following afternoon, however, the pole had been worked in securely. When the beaver is in position to work a stick in, he grasps it with his teeth, shoves it endwise with a side thrust of his head, and then takes a new hold for another shove, and continues this action until the stick lodges.

PLASTERING WITH MUD

For mortar the beaver dives to the bottom of the pond, scoops up armfuls of mud, and carries the load pressed against his chest and chin. In climbing on to the lodge, it is often necessary for him to hold the mud with only one forepaw, the other being used to assist in climbing up the tangled mass. The beaver clambers up on hind legs, braced by the tail, bending over to lay his stomach against the roof as he loses his balance. Arriving at the desired spot, he places the mud in a crevice and pats it in firmly, not with his tail, but with his forepaws, kneading it in place.

Frequently he falls when climbing on to his roof, but the spills are without serious consequence. When the hind foot rests over sharp sticks which gouge the thin web, one shudders as the beaver places all his weight upon it, but evidently it is tough, because a stripped or punctured web is rare.

When cold weather freezes the mud, which has been mortared around the interlocked poles and sticks, the beaver is protected by the forerunner of our re-inforced concrete. Then his home defies even a bear.

In nature and disposition the beaver is one of the kindest creatures on earth.



© Wendell Chapman

When cold weather freezes the mud that is plastered on the beaver's house, this becomes strong enough to defy even a bear

With the approach of winter the beaver puts his lodge in good repair, often covering it with mud until the poles are barely visible

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So lacking in fear were these beavers that they did not hesitate to turn their backs toward Doctor and Mrs. Chapman

WINTER

Beaver frequently ate from Doctor and Mrs. Chapman's hands, even touching them with forepaws and noses. However, they seldom





© Wendell Chapman

The "leader" gathers several small branches with his forepaws, and adjusts them in his mouth, in order to carry them to storage

COMES

became so friendly until the sun had gone down, thus making a detailed camera record of their friendlier moments almost impossible

© Wendell Chapman



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When the pond is freezing rapidly the beaver does not venture far from the hole he has broken in the ice

Ice is beginning to form on the pond, but in the under-water "cooler" the beaver's food will keep fresh until springtime

© Wendell Chapman



Although as nervous as a spirited horse when alarmed, ordinarily he is patient, kindly, and persevering. He seldom quarrels with members of his family, and when differences do arise, he protests by mildly blowing, much as a goose does. These differences seldom arise among members of a colony, except when one interferes with the working of another. A beaver likes to accomplish his task alone and resents the near presence of another. He often shoves away a persistent intruder. That usually ends the matter and the trespasser departs without ill humor. In case the intruder is a kitten, the adult beaver does not push it away. He patiently works on as the kitten sniffs up inquiringly at his mouth, gets right under his nose, clambers over the busiest spot, and makes himself a general nuisance. But the kittens are a necessary part of the trials and tribulations of the old beaver.

The adults are not so patient with the three-quarters grown youngsters, sending them away whenever they interfere. Nor are the older children so tolerant with the kittens. But the worst quarrels result merely in a shove or a splashing tug of war over a branch. Members of a beaver colony quarrel only over the privilege of working, not over ownership. The moment a piece is anchored in the storage pile, anyone may take it, ownership being asserted only while the piece is in a beaver's possession.

LACK OF TEAM WORK

One evening we observed an immature beaver crawl up a runway to a standing tree on which its twin brother was cutting. The worker, noticing the advancing comrade, stopped and turned his head around to murmur his gruffest warning. Notwithstanding, the trespasser came on, and as he approached, the first beaver turned around and started shoving. Like a couple of comedians both darted their paws out in unison to push the other in the chest, until finally the intruder lost

his balance and fell over sidewise, whereupon he left.

Although the beaver built their structures as a community, we never observed any evidence of team work. If one bit off more than he could drag to storage, that was his own lookout, and the others did not concern themselves over any difficulty he might have. Nor did he expect help. Such a thing as giving a hand was apparently unknown to these beaver.

We obtained a number of pictures of beaver apparently working together, but in most cases they remained near each other only long enough to be photographed. In some cases an adult tolerated a kitten or half-grown beaver at his side, but team work, as such, seemed foreign to their understanding.

FASTIDIOUSNESS

In habits the beaver is fastidious. Never have we seen stains or excreta anywhere. These are always deposited in water. Ordinarily, rodents are filthy in this respect, as anyone knows who has observed mice or rabbits. The beaver has risen far above his cousins in neatness, as well as in other accomplishments. We were present when a recently abandoned lodge was opened by a Ranger. The rooms were immaculate.

It is indeed fortunate that one of the most exemplary, one of the most fascinating, and one of the most lovable of all our wild animals is beginning to show confidence in man.

Before the white man came, the Indians looked upon the beaver as superior to other animals. They regarded him with superstitious awe, and many tribes never killed the "little brothers." But with the appearance of the fur trader, the Indians were persuaded to trap the "little people," and the beaver learned to avoid the human being.

Only in recent years has this enigma of the wilds again ventured forth in the presence of man.

Drought on a Wet Planet

The disastrous effects of lessened rainfall,
and the widespread havoc that often follows
extended periods of dry weather

by
Charles Fitzhugh Talman

ACCORDING to a recent estimate, the amount of water lying at all times on the surface of the earth exceeds 332,500,000 cubic miles in volume and weighs more than 1,500,000,000,000,000 tons. Every second of the day and night something like 16,000,000 tons of this vast store passes into the atmosphere by way of evaporation and is spread abroad by the winds. At the same average rate of 16,000,000 tons a second, water falls from the sky as rain and snow upon the lands and seas of the globe. We live, therefore, upon a wet planet.

Why, then, such disasters as the one that has taken toll this year in the United States to the extent of thousands of millions of dollars? Why should humanity ever suffer widely for lack of water in a world so generously supplied with it?

There are two explanations of the paradox. First, Nature is outrageously capricious in her distribution of rainfall. About one-third of *terra firma* is always barren because of persistently deficient rain. Another third gets too little on an average to make agriculture a profitable occupation. Over almost all the rest the farmer's business is a gamble on account of frequent or occasional droughts.

Second, man still depends for nearly all his food and clothing directly or indirectly upon plants, which are exceedingly wasteful in their use of water. Plants collect and utilize only a fraction of the rain that falls on fields, pastures, and forests, and they require relatively enormous amounts of water to produce small amounts of material useful to mankind. Probably some day all foodstuffs and clothing materials will be manufactured directly from elementary

substances within the walls of factories instead of being produced by the slow, wasteful, and precarious methods of agriculture and grazing, and then the scourge of drought will be a thing of the past.

The word "drought" applies literally to any state of dryness; but when we speak of "*a* drought" we usually mean a protracted period of dry weather more or less abnormal for the region where it occurs. Our conception of a drought implies, moreover, certain conspicuous effects of such weather, either as exercised directly or through the depletion of water in the soil. These include the withering or stunted growth of vegetation, the shrinking of streams, and the failure of wells and springs.

Mere scarcity of rain does not necessarily bring about droughty conditions. Loss of water from plants and from the soil through evaporation usually plays an important part in a drought, and this process is favored by hot weather, low atmospheric humidity, and high winds. An ideal criterion for defining a "drought" would take account of all factors concerned in reducing available moisture to a harmful extent, but deficient rainfall is the principal factor, and in most quantitative definitions of the term it is the only one considered.

No single definition of this sort has been adopted by meteorologists for use all over the world, because the rainfall requirements of any one region differ widely from those of another, but several have been proposed for use in particular countries. Two have been employed in certain publications of the United States Weather Bureau. According to one, a drought is a period of 30



Publisher's Photo Service
 Above:—A Colorado harvest
 after a sufficiently moist
 growing season



Photo., U. S. Dept. of Agriculture

Left:—An ear of corn from a drought-stricken field, compared with one from a field amply watered. The U. S. Department of Agriculture has determined that for every pound of dry matter produced, a field of corn requires 368 pounds of water

Below:—In South Dakota the 1934 drought has been exceptionally severe, yet such luxuriant crops as this have not been uncommon in previous years

Brown Bros.





Above:—A Texas pasture during the past summer, when a single cow found only a meager supply of food on fifty of these parched acres

Brown Bros.

Right:—A Texas pasture during a season of sufficient rainfall. At such times this is excellent "cow country"



Below:—An Oklahoma farm after a dust storm. Scenes such as this have been common throughout the agricultural West during the past summer



days or more during which the rainfall does not amount to 0.25 inch in any 24 hours. The other defines a drought as a period of 21 days or more during which the rainfall is not more than 30 per cent of the normal.

WHAT IS A DROUGHT?

In Great Britain the Meteorological Office describes as an "absolute drought" a period of more than 14 consecutive days without 0.01 inch of rain on any one day, and as a "partial drought" one of more than 28 consecutive days the mean rainfall of which does not exceed 0.01 inch a day. During the 62 years ending with 1919 there were 69 absolute droughts in London. The term "engineers' drought" is applied by the British to a period of three or more consecutive months, the aggregate rainfall of which does not exceed half the normal amount for the same period.

The meteorologist is often asked by the layman whether a certain drought was more "severe" than another; or, for example, whether the drought of 1930 or that of the present year or some other should be regarded as the most "severe" in American history. How can we measure the severity of a drought in order to make such comparisons?

The extent of territory affected, the total deficiency of rainfall over the area, and the duration of the drought are obviously factors to be considered in estimating its severity. The disastrous effects of a drought depend more upon the time it lasts than upon the total shortage of rain; hence, according to some authorities, severity increases as the square of the duration. These effects are, however, still more dependent upon the kinds of crops and other vegetation exposed to the drought, the stage of plant growth at which it occurs, and other non-meteorological circumstances.

Thus the task of measuring the severity of a drought is one for the economist rather than the meteorologist. We can say categorically whether a certain drought

was more *costly* than another, but whether or not it was more severe in a physical sense is often a difficult question to answer.

So far as the meteorological features of a drought are concerned, the most important one—the shortage of rainfall—is best expressed in tons rather than in the customary inches of depth, since not everybody realizes that an inch of rainfall is equivalent to 113 short tons (101 long tons) of water to the acre. This illuminating method of indicating the magnitude of a drought was employed by the Weather Bureau in a review of the great drought of 1930, in which the Eastern States suffered much more severely than they have suffered this year. The statement reads:

Twenty-seven states had deficient precipitation each month for periods ranging from two to twelve months, and the total shortage for these states during the droughty period was more than 700,000,000,000 tons of water. For the eight states—Maryland, Virginia, West Virginia, Kentucky, Ohio, Missouri, Indiana, and Illinois—most affected by the drought, the shortage was nearly 300,000,000,000 tons, and, in general, for each 100-acre farm, for the three summer months alone, it was about 60,000 tons, or an average of nearly 700 tons a day.

These figures are given in short tons—2,000 pounds to the ton. Thus the daily shortage during the summer on a good-sized farm in the states mentioned averaged 1,400,000 pounds, or about 167,500 U. S. gallons of water, as compared with the supply in a normal year.

WHAT PLANTS REQUIRE

Such figures become even more understandable in relation to drought when we consider the amounts of water that growing plants, if they are to live and thrive, must obtain from the soil. For example: A corn plant takes up about 368 pounds of water for every pound of dry matter it produces. An acre of cabbage plants needs more than 2,000,000 quarts of water in a season. Two hundred beech trees on an acre require nearly double that amount. More than 800 pounds of water must be put into the soil to produce a pound of dry alfalfa. Half

a ton of water is used by a tree in making a pound of wood.

Fortunately for the farmer, the supply of soil water in any region is far more stable than the rainfall of the same region, because there is usually a large reserve of such water deep in the ground, which accumulates in rainy weather (as well as from the melting of snow) and is but slowly depleted when the rainfall fails. If plants depended directly upon rain for their supply of moisture, agriculture would hardly be possible even in nominally humid climates, which are, as a rule, subject to occasional dry spells of long duration. Southern New England, for example, is a well-watered region, with a normal rainfall about double the minimum amount required for ordinary crops; yet statistics show that once every two years, on an average, this region experiences a dry spell lasting 30 days or more, during which no day brings as much as a quarter of an inch of rain.

LOWERED WATER-TABLES

A serious depletion of soil water results from persistent drought, and especially from a succession of droughty years. Gradually the water-table—the upper limit of saturated soil—from which the roots of plants draw water either directly or through the wicklike action of intervening soil, sinks below the reach of all but the deepest-rooted plants. The soil down to a considerable depth becomes so dry and powdery that the water from occasional showers seeps rapidly through it and is lost to plants. With the general killing of vegetation, the bare surface soil is easily swept up by the winds in clouds of dust, which may assume spectacular proportions and spread far beyond their place of origin, as has happened from time to time this year in the United States.

The unprecedented epidemic of dust storms in this country during the past spring and summer, though probably due in part to unwise agricultural methods and extensive over-grazing—both of which have stripped the land of protective natural vegeta-

tion—appears to have been also the result of an enormous reduction of soil water in regions where there has been a general downward “trend” of rainfall for many years.

A DECLINE IN RAINFALL

An analysis of rainfall records made by J. B. Kincer, of the Weather Bureau, shows that over a large area of the northern Middle West, centering in Minnesota, this decline has been in progress for the past twenty-five years, being one of a series of slow upward and downward swings revealed by records extending over the past century. During these swings the rainfall of individual years has sometimes departed widely from the prevailing upward or downward tendency, but the latter is plainly shown by a curve plotted from the averages of overlapping periods of ten years each, each ten-year period beginning a year later than the preceding one.

Similar slow oscillations of rainfall appear to be fairly common throughout the world and there has been much discussion as to their causes. One of their effects has been to foster the delusion that the rainfall of various parts of the world has changed permanently for better or worse within historic times. Unfortunately these trends, though they are of great economic importance, are too indefinite and irregular to afford a safe basis for long-range forecasts of drought.

With the doubtful exception of floods, droughts have, in the aggregate, cost more human lives and caused more misery and destruction than any other disasters of atmospheric origin. In their ultimate effects—as, for example, in provoking wars, migrations, and social upheavals—they have undoubtedly played a much greater part in human affairs than have all other weather disasters combined. In the United States severe droughts have been the commonest cause of commercial panics and have often caused an extensive transfer of population from one part of the country to another.



Photo., U. S. Weather Bureau

A great dust cloud advancing over the plains. The frequency of dust storms in the middle and western United States in 1934 surpassed all previous records. During May an enormous cloud of dust from the parched lands west of the Mississippi swept over the eastern states and far out over the Atlantic Ocean



Drought on the range. Conditions throughout the drought-stricken region have often been tragic. The people of great areas have required aid, and thousands of head of live stock have perished miserably

Photo., U. S. Dept. of Agriculture



Brown Bros.

“Before”

Farms that in the recent past have been as pleasant and productive as this South Dakota dairy farm were turned, during the past season, into desert-like wastes, with the streams dried up, the grass gone, and even the leaves of the trees withered and lifeless

Before immigration was restricted, every great drought in Europe promoted a larger exodus than usual to the New World.

The days of famines due to drought are by no means over. Russia and Persia have experienced them on an immense scale during the present generation; China, which suffers from them at frequent intervals, is enduring a terrible one now. In the past they were not only commonplace events but were viewed complacently by philosophers and government administrators as a natural check on the growth of population.

DROUGHTS AND FAMINE

Until England shouldered the white man's burden in India, the droughts of that country caused famine on a colossal scale. One reads in the old chronicles of drought-bred famines in which "the land became densely covered with bones in all directions, until it was like one great burying-ground." The famine of 1769-70 destroyed one-third the population of Bengal. As recently as 1876-77 five million people died of hunger in India as a sequel of drought.

In civilized and well-governed countries today human beings no longer perish of hunger and thirst in time of drought, though they still endure much misery on account of the visitation and a good many may eventually die from its indirect effects. One common result of prolonged drought is the pollution of drinking water, leading to outbreaks of typhoid and other diseases. On the other hand, a severe drought, wherever it occurs, causes suffering and mortality on a vast scale among the lower animals, both wild and domesticated. Many thousands of animals purchased this year by the United States Government to save them from starvation were so emaciated that they were unfit for shipping to market. In the summer of 1930 it was reported that more than 10,000 horses died in the fields of Iowa in a single week.

In her vivid novel *The Wind*, Dorothy Scarborough pictures this phase of a drought as witnessed on one of the old-time Texas

ranges, where the water holes had dried up and there was no railroad near to haul water:

The plains in their terrible distinctness showed dead prairie dogs, dead jack-rabbits here and there. They had perished for lack of food and water. Only the coyotes remained, and they prowled night and day, for they lived on flesh and grew fat on the bodies of the dead. There were no song-birds left; only the buzzards—carrion birds.

Gaunt, cadaverous beasts staggered about, tortured by heel-flies that nagged them constantly; bawling in distress, searching everywhere for food and water. They had devoured every spear of the dried bunch grass and needle grass, every leaf and bean from the mesquite bushes, every stalk of last year's weeds, and now there was nothing! They came close to the house, as if making appeal to their masters not to abandon them to death.

They pawed the ground, as if to find food deep-buried there; some greenness under the tricky sand, some water beneath the burning desert. Some of them threw their heads around to the side, as if the torture of thirst twisted the muscles. Their tongues swelled, turned black, protruded from their mouths. Some of them went mad from thirst and fought, goring each other to death.

Capt. W. F. Owen, in the narrative of his African voyages, tells how the large town of Benguella, in Portuguese West Africa, was once invaded by thirsty elephants, who fought a bloody battle with the inhabitants for possession of the wells. Darwin, in his *Naturalist's Voyage*, pictures the frightful ravages wrought by the "gran seco" of 1827-30 among the cattle of Argentina, a million head of which perished in the province of Buenos Aires alone. He says:

I was informed by an eye-witness that the cattle in herds of thousands rushed into the Parana and, being exhausted by hunger, were unable to crawl up the muddy banks and thus were drowned. The arm of the river which runs by San Pedro was so full of

Photograph on opposite page by Ewing Galloway

THREE-QUARTERS OF A CENTURY AGO ALMOST EVERY MAP OF THE WESTERN PART OF THE UNITED STATES SHOWED A VAST AREA THAT WAS CALLED "THE GREAT AMERICAN DESERT." THIS IDAHO WHEAT FIELD WAS, AT THAT TIME, AN UNDREAMED OF POSSIBILITY. SO SEVERE WERE THE DROUGHT CONDITIONS OF 1934, HOWEVER, THAT MANY FIELDS ONCE AS PRODUCTIVE AS THIS HAVE BEEN TURNED INTO PARCHED WINDROWS OF SHIFTING DUST, FROM WHICH EVEN THE SEED WAS BLOWN



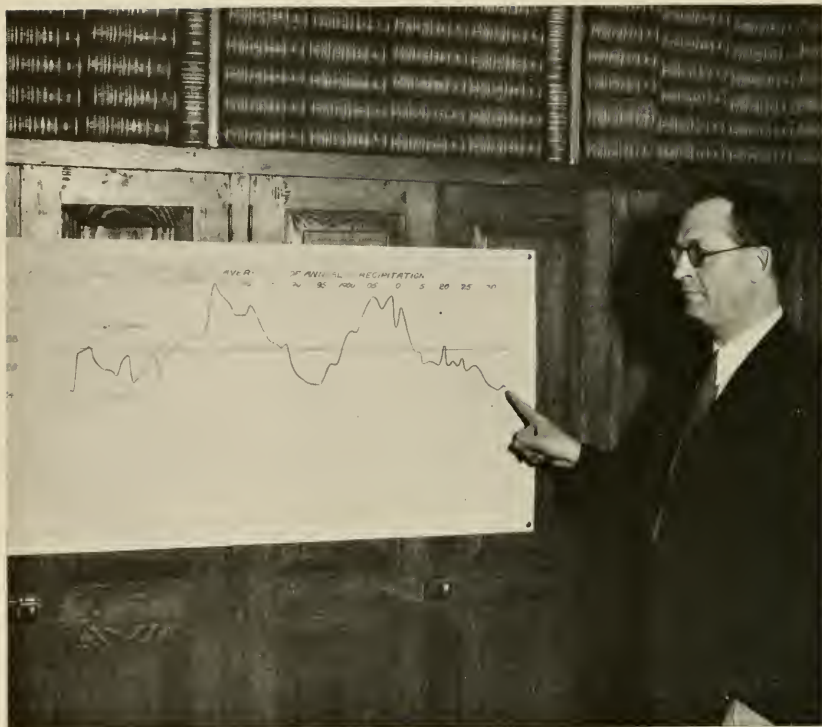


Photo., U. S. Dept. of Agriculture

Rainfall history is not merely a matter of "dry" and "wet" years. Mr. J. B. Kincer, of the Weather Bureau, is shown here with his record of "secular trends" of rainfall in the upper Mississippi Valley. It shows a general decline in rainfall during the last twenty-
7 five years



Photo., U. S. Forest Service

A drought is commonly thought of as due entirely to scanty rainfall, but the loss of moisture from the soil and from plants by evaporation is usually an important factor. An "evaporation pan" is shown here, by means of which the rate of evaporation can readily be determined

putrid carcasses that the master of a vessel told me the smell rendered it quite impassable. Without doubt several hundred thousand animals thus perished in the river.

The effects of a great drought are extremely varied. One, of which we have heard much this year, is a marked increase in the number and destructiveness of forest fires. Apart from this effect of drought on forests, millions of saplings die for want of water, and the larger trees that survive make much less than the normal annual addition of wood to the nation's timber resources. With the exhaustion of pastures, poisonous weeds are extensively eaten by live stock, resulting in much sickness and mortality. Some insect pests thrive on drought, though others, fortunately, are curbed by it. Scarcity of water for industrial use sometimes occasions heavy losses; as, for example, where large hydroelectric plants are forced to close down or resort to steam. The whole catalogue of evils that drought brings in its train is much too long to set forth here.

WHAT CAUSES DROUGHTS

The causes of droughts are disturbances—of unknown origin—in the normal circulation of the earth's atmosphere. It is the winds that spread water vapor over the earth and, as they cool, especially by expanding as a result of upward movements, condense it into clouds and deposit it as rain and snow. An active interchange of air currents tends, in general, to bring precipitation; a stagnant state of the air to bring dry weather.

The trade winds of the South Atlantic Ocean supply rainfall—too much of it, at times—to northeastern Brazil, but it appears that now and then these winds slacken or shift a little from their habitual courses, and

then the "Nordeste" suffers from the ruinous droughts for which it is world-renowned. The southwest monsoon blowing in summer and autumn from adjacent waters provides the bulk of India's rainfall; but in some seasons the monsoon is weak or irregular, and the crops fail. The swirling winds of "lows," or barometric depressions, that travel in endless succession from west to east across the United States bring us ample rain or withhold it, according to their frequency and intensity and the courses they pursue.

DISTANT CAUSES

The atmosphere is always quite unevenly distributed over the globe—piled up in some regions and deficient in others—as can be seen from a comparison of barometer readings made simultaneously at different places, and variations in the winds are associated with variations in these inequalities of atmospheric mass and pressure. Displacements of air and attendant dislocations of wind systems appear to be more or less definitely interconnected all over the world. Thus abnormalities in the Indian monsoon are found to be related to abnormalities of winds and weather in South America, the Aleutian Islands, and other distant regions; and it is not improbable that a drought in Iowa or Nebraska may be related to unusual atmospheric conditions that prevail in places thousands of miles away.

One of the most striking recent developments in meteorology is the eager search now in progress for "teleconnections" of world weather and the attempts made—officially in India and some other countries—to predict the dryness or wetness of coming seasons on the basis of these interrelations.

Ornaments of Pre-Columbian Central America

by

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The fifth of a series of articles on
Central American art

CENTRAL American ornaments resemble the antique jewelry of Europe in that skillful workmanship contributed more to the value of a piece than the intrinsic worth of the stone or metal. The cost of a jewel was not expressed by its size, as in the case of those modern diamond rings which reflect so clearly the bank notes tendered in payment.

The ancient Central Americans worked, as precious, such stones as jade, turquoise, obsidian, rock crystal, amethyst, opal, beryl, onyx, and carnelian, not to speak of other stones resembling these in textures and color. Around the Isthmus of Panama emeralds were used as ornament, and they have been reported also among the Aztecs. Metals employed for jewelry included gold and copper, but silver ornaments are extremely rare, owing to the metallurgical skill required for extracting the ore. If few of the stones which we moderns consider precious are represented in this list, it should be recalled that the ancient Mediterranean peoples, notably the Egyptians, Greeks, and Romans, knew equally little of our modern gem stones. Their ideas of value were certainly as developed as our own, but to them the sources for modern precious stones were almost completely closed.

The stone most generally esteemed by the Central Americans was jade. The

New World varieties are distinguishable from the Asiatic jade, not only in chemical composition, but also in that elusive trait called "feel." Considerable mystery surrounds the exact origin of American jade, because no natural deposits have yet been found in Central America. The few specimens that reveal the original shape of the raw product suggest that jade was collected in boulder form from stream beds but was not mined from the veins. It is quite possible that the more accessible places producing jade have been effectually gleaned of the precious substance by the ancient inhabitants, even as the Spaniards in the Colonial period exhausted the gold deposits which could be worked by hand. From the general distribution of jade objects according to the towns listed in the native manuscripts as paying tribute in that medium, the chief source must have been within the limits of the modern states of Oaxaca, Guerrero, Chiapas, and southern Vera Cruz. Costa Rica also produced much jade ornament, but the workmanship is not comparable to that of the north.

The value of jade to the Central Americans can be authenticated in various ways. The finest work and most skillful sculpture are lavished on objects of this stone. The tribute rolls show a constant demand for jade beads and ornaments. The Nahuatl word for jade "chalchihuitl" and its hieroglyph were used with the connotation of "precious," and in describing the adornments of gods and chieftains,

Jade is among the hardest of stones, and was most precious to the ancient Central Americans. They worked it without metal tools, so that the manufacture of ornaments like these must have required months of labor. New World jade can readily be distinguished from the Old World variety



Jade and Jadeite

The three jade sculptures shown on this page are among the treasures of the American Museum of Natural History. The middle photograph represents a small figure in the Maya style from Ocosingo, Chiapas. The top and bottom figures represent the same tiger-faced divinity. The seated figure is a little more than three inches high, but the upper one is more than a foot, and is the largest carved jade from Central America. Both carvings may be the work of the semi-mythical Olmecs of Vera Cruz

the chroniclers refer to jade in the same luscious way that we describe the diamonds of the mighty in our own society. Jade was prominent in the lists of gifts made by the native rulers to the Spaniards at the time of the Conquest. Finally, we have the testimony of the Conquistador, Bernal Diaz, our most engaging first-hand source on the Ancient Mexicans. In describing how the Spaniards looted the treasure of Montezuma's father, previous to their disastrous sortie from Mexico City during the Noche Triste, he says, " . . . Many of the soldiers of Narvaez and some of our people loaded themselves with it (gold). I declare that I had no other desire, but the desire to save my life, but I did not fail to carry off from some small boxes that were there four chalchihuites (jades) which are stones very highly prized among the Indians, and I quickly placed them in my bosom under my armor, and later on the price of them served me well in healing my wounds and getting me food." No one who has read *The True History of the Conquest of New Spain* would ever doubt Bernal Diaz's practical sense of economic values.

USES OF JADE IN CENTRAL AMERICA

The uses of jade were manifold. Axes and chisels were ground out that were not only æsthetically pleasing in their polished symmetry, but also, due to their hardness, extremely useful in carving softer stones for major sculptures. Ornaments comprised sets of beads, often matched as to color and size, ear-plugs, and pendants. Some of the ear-plugs were too large for human use, and this type of jewelry must have been made especially for the statues of the gods. Little pendants often engraved with floral designs or human figures are most pleasing, since they combine the natural luster of the stone with the balance of design inherent in Central American craftsmanship.

The process of manufacture must have been laborious, to judge from the unfin-

ished fragments that have been found. The jade pebbles were often sawed into slabs by means of a string of rawhide used in connection with a rude abrasive like sand and water. Pecking and grinding must also have helped to reduce the irregularities of the natural stone. In the Oaxaca specimens especially, one sees evidence that a circular drill of bone or reed was used to engrave many elements of the decorative design. Some of the secondary details may have been brought out by sharp-edged flakes of obsidian. Finally the artisan imparted a lustrous polish to the specimen.

MAIN STEPS IN WORKING STONE

Prof. M. H. Saville acquired for this Museum a series of onyx vases that illustrate very neatly the main processes in working stone. First there was the primary stage of pecking out the block into the desired external form. The next stage lay in hollowing the interior by isolating with a tubular drill thin columns of stone, which could be readily broken out. A third step consisted of smoothing off the irregularities left by pecking and boring. Then the final details were added, and a general burnish completed the vessel. There is no doubt that this general method applied to the working of all the harder stones, with the substitution of sawing for drilling when the need demanded.

Yet the true beauty of jade is expressed by a series of small sculptures that bring out in miniature all the consummate design of the major plastic art. These small idols, like the Necaxa "tiger" and the larger votive axe from Vera Cruz, illustrate that element of monumentality which the better examples of Central American sculpture possess. By the term "monumentality" I mean the capacity of a carved figure to be indefinitely enlarged or reduced so that the sculpture, due to the balance of the elements involved in the composition, is neither distorted by the one nor diminished in dignity by the other.



This tiny rock crystal skull represents countless hours of labor, and is one of the three finest specimens in the world. It is probably the work of an Aztec lapidary

Crystal,
Copper, and
Serpentine



Copper was occasionally used for ornament, as is attested by this large bell sculptured in repoussé. The negroid features suggest a point of origin in southeastern Mexico



The little baby-faced figure to the left resembles the jade figure on page 579. The statuette is of serpentine, and the technique of carving suggests an imitation of the effects obtainable in the harder green stone, jade

The Necaxa tiger, although only three inches high, is as impressive as if it were thirty feet. The Ocosingo jades, representing softer influences from the Maya country, lose nothing in comparison with the monumental reliefs with which the Mayas enhanced their stelae and temple walls. In fact, from our modern point of view, we can comprehend these minor carvings more readily than the great, since a *biblot* one can keep and handle, but massive religious sculpture seems to belong to the god in whose honor it was created.

SUBSTITUTES FOR JADE

Many greenish stones, like porphyry, serpentine, and wernerite, the native jewelers worked in a manner similar to jade. Perhaps they could not distinguish these minerals from jade, or perhaps they knew that through the substitution of softer stones they could attain the same effect achieved in the harder and rarer medium. That extraordinary group of sculptures, attributable perhaps to the legendary Olmees, depicts people with tiger and baby faces, both in jade and other stones.

The work in rock crystal, due to the excessive hardness of the material is, from the technical point of view, even more impressive than the jade sculpture. A few examples exist from various sites of beads and pendants. The most famous example, however, is the nearly life-size skull in the British Museum, and a miniature, illustrated for the first time in these pages, is one of the treasures of the American Museum of Natural History. The rock crystal vase, found by Doctor Caso in Tomb 7 at Monte Alban, represents even more strikingly the days of patient work that the creation of one of these masterpieces must have consumed, in the absence of any of our modern mechanical aids.

Ear-plugs and labrets of obsidian (volcanic glass) ground so thin as to be almost transparent, indicate that this useful substance was treated on occasion as a gemstone, and sometimes it was used as a ma-

terial for sculpture. Even iron pyrites, commonly ground to make mirrors, was at least in one instance carved, as is attested by a lovely example in the Trocadero. Amethyst, opal, carnelian, and the like have been utilized as beads, while turquoise was used above all for mosaic work. The accounts of the loot of the Conquistadores mention emeralds, but they may have been exceptionally fine jades. In fact, of all the stones treated as precious by the Central Americans, jadeite and nephrite produce the most conspicuous examples of the lapidary's finesse. In civilizations so essentially religious in character as those in Central America, it is to be expected that the work in their most precious stone would produce a sculpture comparable in every way, except size, to the best monumental examples.

Although we have insisted that jade was more valuable than gold to the ancient Central Americans, and Bernal Diaz quotes Montezuma's ambassador as saying "that these rich stones of chalchihuite (jade) . . . were of the highest value, each one being worth more and being esteemed more highly than a great load of gold," this precious metal none the less had value among the Central Americans. Copper was also worked as ornament, but it was more commonly fashioned into tools. On the other hand, gold, save for some sporadic mentions of fishhooks, seems to have been reserved for ornament.

THE ORIGIN OF GOLD WORK TECHNIQUE

The techniques for working gold were apparently invented in northern South America. Indeed, Colombia and Ecuador have produced in sheer bulk the greatest Indian treasures exhumed in the New World. From these countries the gold-worker's art spread through Panama to Costa Rica. Perhaps because the sources of the raw metal were negligible, there is no further great development of gold-working, until one reaches southern and central Mexico. There we find the cleverest goldsmithing

in the New World, although no addition seems to have been made to the fundamental techniques of manufacture imported from the South.

HOW GOLD ORNAMENTS WERE MADE

The Central Americans apparently knew nothing of smelting or other methods of separating the metal from the ore, for they extracted grains and nuggets of gold from river beds. This raw metal they melted down and worked either by hammering or casting. This latter method is extremely ingenious, since it is like the European *cire-perdue* process. The pattern to be cast was engraved on specially treated clay over which was spread a layer of wax. The wax-covered pattern was then coated with more clay through which a wax-filled aperture was made. The mold was then baked, during which process the wax melted and ran out. The molten metal was poured into the resultant cavity, and when the gold had cooled, the mold was broken in order to extract the ornament which, save for a final polishing, was then ready for use.

The Central American goldsmiths knew how to plate copper with gold, and in Mexico they sometimes fused gold and silver into a single ornament. According to contemporary accounts, animals were made with movable legs, and fish with the scales so cunningly jointed that they wriggled. In Mexico they knew how to beat out gold leaf and apply it to objects of wood and stone, while there was considerable work in repoussé, which involves the beating out of a pattern in relief from the reverse of a gold or copper plate.

The regions producing gold ornaments are characterized by various types and styles of presentation. A rich gold art emanates from a chieftain's tomb in the province of Coclé, Panama, scientifically excavated by the archæologists of the Peabody Museum of Harvard University. Here delightful animal figures contrast with the austerity of heavy ornaments and

ceremonial discs in repoussé. Another group of gold objects comes from Costa Rica in the magnificent collection of Minor C. Keith, half of which is on view in the American Museum of Natural History. There are close parallels between this art and that of Panama, and here also one may enjoy the fresh vitality of little animals like frogs, crabs, and armadillos, as well as marvel at the bulk of formal ornament. An earring representing an animal seated in a swing indicates a quaint humanitarianism unwilling to allow even an ornamental beast to dangle by its neck. A whole collection of birds of various sizes could serve as models to jewelers today, so marked is the *chic* of the cleverly conventionalized forms. There is a considerable amount of copper plating and copper alloy that attest to some skill in metallurgy.

In the region occupied by the great Maya cities, there has appeared even less gold than jade, and both seem to owe their presence to trade. The Sacred Well at Chichen Itza, source of the greatest treasure hitherto found in the Maya area, yielded gold ornaments obtained from as far as Costa Rica to the southeast and southern Mexico to the southwest. It is not until the frontier between the Highland and Maya cultures is reached that we find the great development of gold-working.

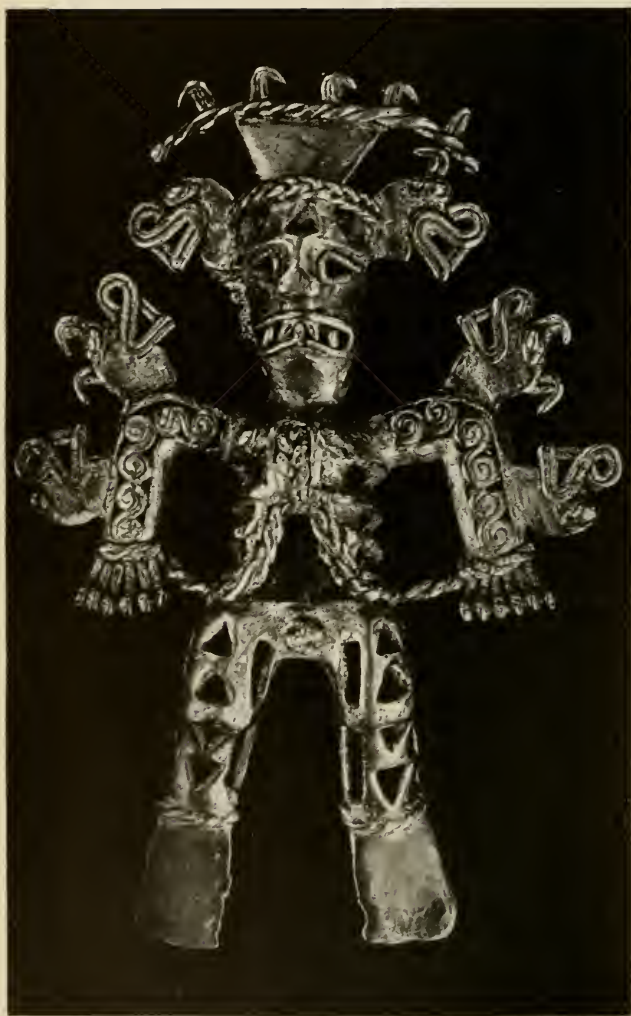
NOTABLE EXAMPLES OF GOLD WORK

According to Prof. M. H. Saville, whose *Goldsmith's Art in Ancient Mexico* is the authoritative work on this subject, northern Oaxaca produced more notable gold objects than any other section of Mexico, and this statement was made before the discovery of the treasure in Tomb 7 at Monte Alban. Nor can this rich harvest be entirely due to the drain put by the Spaniards on other parts of Mexico, since they were as active in Oaxaca as anywhere else. A soldier named Figueroa, according to Bernal Diaz, gave up trying to conquer the Indian tribes of Mixteca and

This ornament (after Saville, 1920) is an exquisite example of Mixtec jewelry in the National Museum of Mexico. It imitates a feather-mosaic shield and the background is turquoise inlay



Central American Goldwork



The gold ornaments in the photograph above and at the lower right illustrate the barbaric jewels of Panama and Costa Rica. However, a strong sense of design gives to the four massive brooches a highly decorative effect. The group of five little animals (right, above) is more naturalistic in treatment, although a bird-headed monkey is a beast met more commonly in mythology than in a zoo



The three little ornaments above (after Saville, 1920) came from Oaxaca, and show the extraordinary skill of the Mixtec goldworkers in their reproduction of a harpy eagle, a monkey, and a horned owl. Note especially the treatment of the owl's feathers. It is a tragedy that so much of this lovely ornament found its way to the Spanish melting pot



"determined to undertake the excavation of graves in the burial places of the Caciques of these provinces, for he found in them a quantity of gold jewels . . . and he attained such dexterity that he took out from these over five thousand pesos de oro in addition to other jewels obtained from the pueblos." The enormous yield of Doctor Caso's remarkable discovery at Monte Alban gives an idea of the scope of the gold-worker's industry there. Finger rings, to wear below the knuckle and at the first joint, bore representations of eagles executed in filigree. Necklaces arranged in decorative tiers and massive gorgets depicting gods and religious symbols gave evidence of a sumptuous ceremonialism. Pearls also were scattered about the tomb and innumerable fragments of turquoise attested to disintegrated mosaics. Sophisticated as was the subject matter of the Monte Alban jewels, the outlines of some of the gorgets show the southern ancestry of the goldsmith's art in Oaxaca.

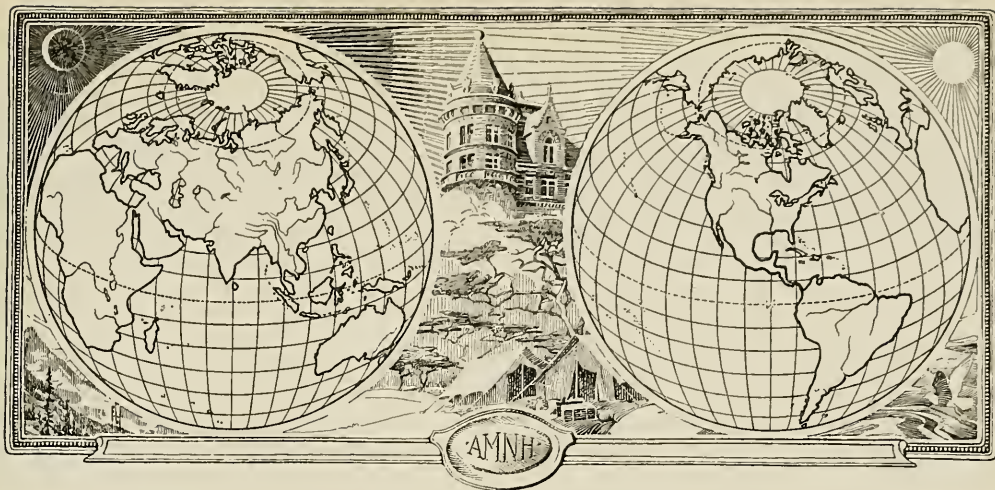
MUSEUM PIECES

The collections of the American Museum reveal a few consummate examples of gold work. A small owl's head, complete even to the overlapping feathers, corroborates the tales of the Conquistadores and shows a technical precision not unworthy to be compared with Benvenuto Cellini's artistry. A haughty little harpy eagle head combines naturalism with a strong sense of decorative values, and a large lip ornament representing an eagle head subordinates naturalistic detail to design, without distorting the essential realism of the reproduction. Even beads are carefully worked into forms which are as satisfactory individually as they are when grouped as a necklace.

The Aztec gold work, thanks to the assidu-

ous looting of the Spaniards, has almost completely disappeared. We know that there was a guild of goldsmiths, high in social standing, who inhabited a special quarter of Azcapotzalco and claimed descent from the legendary Toltecs. Conspicuous in the tribute sent by Cortes to his king was a golden "wheel" six and a half feet in diameter, inscribed like the famous "calendar stone" with the sun, day signs, and other symbolic elements relating to time as recorded by the Aztecs. Cortes was also the recipient of a necklace in which golden scorpions were a conspicuous element. How far the Aztec goldsmiths were influenced by Oaxacan styles the dearth of specimens from the Valley of Mexico prevents our saying, but in the lists of Spanish loot there is a general correspondence between the descriptions of the Aztec treasure and the different types of ornament recovered in Oaxaca.

The jeweler's art in Central America, as can be seen by the illustrations accompanying this article, is capably developed and appears less alien to our modern tastes than the major arts. Personal eclecticism and the joy of individual possession influence one's taste in ornament to a great degree. A contributory factor in the appreciation of an art is the possibility of incorporating examples in one's own milieu, a condition difficult to envisage with the major examples of Central American arts. However, to keep as a *biblot* a jade ornament, or to wear a gold idol as a brooch or charm is perfectly feasible, since such an action involves no violent adjustment of æsthetic or ideological conceptions. Perhaps the sheer craftsmanship of the Central American jewel worker will lead us to as close an appreciation of Central American art as any other factor in these remarkable civilizations.



Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by
A. Katherine Berger

American Museum Radio Broadcasts

In line with President Davison's policy to make every effort to increase general public interest in natural history subjects, the American Museum this fall is participating in a series of broadcasts which brings to the microphone many members of the Museum's scientific staff and other widely known explorers who, in the form of interviews with Mr. Hans Christian Adamson, also of the Museum staff, will discuss their discoveries and explorations in remote corners of the globe.

These broadcasts, given in coöperation with the American Bosch Radio Corporation, are presented every Sunday afternoon at 5:30 o'clock from station WJZ over a coast-to-coast hook-up of about three dozen stations of the National Broadcasting Company.

The first of the series began on August 19 when President Davison gave a realistic account of how he and his party made close-range observations of lions in Africa. On the following Sunday, Dr. Roy Chapman Andrews, acting director of the Museum, took the Radio Explorers with him to the Gobi and recreated the dramatic discovery of the shovel-toothed mastodon.

On Sunday, September 2, Colonel Theodore Roosevelt talked about his expedition for specimens of the rare *Ovis poli* in the Himalaya Mountains. He was followed on September 9 by Dr. Robert

Cushman Murphy, who discussed "Life Among the Penguins." Other speakers and their subjects follow:

- Sept. 16—Martin Johnson, "Exploring the 'Dark Continent' by Airplane."
 " 23—Dr. Vilhjalmur Stefansson, "Strange Truths about the Arctic";
 " 30—Amelia Earhart, "Adventures in Aviation";
 Oct. 7—William J. Morden, "Hunting the Siberian Snow Tiger";
 " 14—Dr. Clyde Fisher, "Startling Facts about the Stratosphere";
 " 21—Prof. William K. Gregory, "Australian Explorations";
 " 28—Dr. James L. Clark, "Captured by Mongolian Bandits";
 Nov. 4—Mrs. F. Trubee Davison, "Hunting Elephants and Leopards in Africa";
 " 11—Harry C. Raven, "Gorillas"

The foregoing schedule is subject to change, should conditions make it necessary.

"These broadcasts," said President Davison in announcing the program, "form one more step in the American Museum's efforts to increase public interest in natural history. We believe that they provide a splendid opportunity to bring the Museum to those who live too far from New York to visit it. On the other hand, these weekly talks should

create added interest on the part of those who reside in or near New York.

“Radio presentations along the line followed in this series of broadcasts is a new undertaking for the Museum, and I sincerely trust that our members and friends will not alone enjoy them but also give us such helpful criticism as they may feel disposed to render.”

The program will be broadcast in the following cities:

| | | | |
|-----------------|-------------|----------------------|-----------------|
| Louisville, Ky. | New York | Detroit | Milwaukee |
| Nashville | Boston | Cincinnati | Madison |
| Memphis | Springfield | Chicago | Minn. St. Paul |
| Atlanta | Baltimore | St. Louis | Duluth-Superior |
| Birmingham | Washington | Cedar Rapids | Fargo |
| Jackson | Syracuse | Des Moines | Bismarck |
| New Orleans | Rochester | Omaha-Council Bluffs | San Francisco |
| Denver | Pittsburgh | Kansas City | Los Angeles |
| Salt Lake City | Cleveland | Oklahoma City | Portland |
| Spokane | Tulsa | Dallas-Fort Worth | Seattle |
| Houston | San Antonio | Shreveport | Hot Springs |

Pre-Inca Civilization

Dr. Wendell C. Bennett, assistant curator in anthropology at the American Museum, has just returned from South America, where he has been since last December continuing the survey and excavation in the high plateau of Bolivia begun by the Museum expedition of 1932. The object of the survey is to study the distribution of Tiahuanaco culture, a Pre-Inca civilization which had its center in Tiahuanaco.

Among the important results of this expedition was the finding of well preserved foundations of house sites which furnished many details heretofore unknown. One house was about 30 feet long and 15 feet wide on the outside. There were double walls, each more than a foot thick, and a space was left between the walls for storage. These bins were entered from the inside of the house through square window-niches, decorated with stepped edges. There was only one door to the house and no outside windows. The doorway was well paved with flat stones. A long slot on one side of the doorway was once filled with a wooden slab which could be slid back and forth. A sliding doorway is, Doctor Bennett believes, a new type for South American archaeology. The walls of the room were plastered with a well backed and polished clay.

Twelve tombs were found under the floor of this house containing skeletons of children and adults. Fragments of the cloth blankets with which they had been covered were still preserved,—the only cloth Doctor Bennett has ever found in this country of heavy rains. Every indication was that the burials had been made one by one while the occupants continued to live in the house.

Bone needles and knives, stone axes and grinders, and many fragments of cooking bowls and other pottery furnish clues to the identification of the dwellers. A grain, called quinoa, was found, which is the popular food of the Indians today.

Two temples were also discovered, one of which, when excavated, proved to be about 30 feet square, with walls of cut and dressed granite blocks, some decorated with inset niches. Two elaborately cut upright lava pillars formed a gateway. The temple was of undoubted Tiahuanaco style, and pottery discovered there suggests that the temple may have been dedicated to puma worship.

NATURAL HISTORY hopes to publish in a later issue an article telling the story of these interesting finds.

Important Fossil Discoveries in Wyoming

Barnum Brown, who went out to Wyoming in the spring of 1934 intending to excavate and ship back to the American Museum two fossil Sauropods which he had discovered on a previous expedition, stumbled upon the remains of a whole herd of prehistoric animals. Doctor Brown considers this one of the most important finds in his whole history of exploration, and he is now hard at work removing the bones from their age-old burial place. When ready for shipment, the bones will weigh in excess of 75,000 pounds, and will fill two freight cars. Doctor Brown is planning to remain in the field until December.

Honors

Prof. Henry Fairfield Osborn recently was the recipient of a Diploma of Membership in the Academia Asiatica, Teheran, Persia, which had elected him an Honorary Member at its General Assembly on January 13, 1932. At the same time a similar Diploma of Membership was conferred upon the American Museum.

A Giant Meteor Seen in New York

New Yorkers had the opportunity recently of viewing an unusually brilliant meteor, or fire-ball, provided they were star gazing at the right moment. This celestial visitor, which flashed across the sky about 9:30 on Monday evening, July 23, 1934, was described by many as resembling a huge airplane on fire. It faded from view after approximately four seconds, and flared up near the end of its course, bursting like a rocket. That it was not merely one of the small garden variety of shooting-stars, such as are seen on any clear night, is evidenced by the fact that its flight was visible over New Jersey, New York, Connecticut, and Rhode Island. The geology and astronomy departments of the American Museum have received many reports from spectators of this cosmic display, the most remarkable coming from Mr. Vail, of Madison, New Jersey, where the meteor not only outshone the full moon, but rivaled those intensely white magnesium flares used in war time to illuminate the landscape. Though its actual path through the earth's atmosphere has not yet been determined, it is known that fire-balls appear on the average at a height of about 85 miles

above the earth, and disappear at a height of about 30 miles, often traveling in the meantime a distance of 200 miles or more.—A. L. DRAPER.

A New Color Exhibit in the American Museum

Mutations, or germinal changes, are the first stages in the formation of new species. Hence the various color "sports" sometimes found in nature are of special interest to the naturalist. In the Hall of Reptiles an exhibit of living specimens has recently been arranged to show three types of color mutations. These include a bright yellow variety of the common pond frog; a black, melanistic form of the garter snake; and a red variation of the chicken snake. By way of comparison a normal specimen of each species is also included in the exhibit.

The green color of the normal pond frog is not due to green pigment but to a reflection phenomenon. The short light rays falling on the skin of the frog are reflected back by certain guanine-containing cells which are backed up by black pigments. These reflected rays are passed through a filter of oil-containing cells which give the green appearance to the skin. The yellow "sport" lacks the black pigment cells, and consequently the short light waves are not reflected back through the yellow filter; as a result the skin appears not green but yellow.

The innovation of live frogs and snakes in the Reptile Hall makes the exhibit particularly valuable.

A Memorial to B. T. B. Hyde

Sunday, August 5, 1934, marked the unveiling of a bronze memorial tablet dedicated to the late Benjamin Talbot Babbitt Hyde ("Uncle Benny") at the Kanawauke Lakes, Palisades Interstate Park. It was here that "Uncle Benny" in the summer of 1920 began his work in nature education at the Boy Scout Foundation Camp near Bear Mountain, and where he established the first out-of-doors museum.

The tablet was unveiled by Major William A. Welch, who spoke briefly of Uncle Benny's great contribution to child life in America through his interest in natural history education, particularly in the Interstate Park.

Following are excerpts from a tribute to Uncle Benny by Mr. William Gould Vinal, of Western Reserve University, on this occasion:

Just a few days over a year ago, Uncle Benny passed away at Santa Fé, New Mexico, on July 27, 1933. He was 61 years old. There are those here who knew him, but all of you belong to his day. This is Uncle Benny's home. He was nature leader here from 1920 to 1926. He did not seek the metropolis nor main highways. He sought the byways. He above all others would have us take him as he was, in the spirit of simplicity. He was straightforward, outspoken, sincere, good-natured, popular and well known. Nearly all his life was spent in service to others. The hey-day of his experiences emanated from this peninsula.

There was only one Uncle Benny. He was never Benjamin Talbot Babbitt Hyde. It is right that the words "Uncle Benny" should top this plaque. He was Uncle Benny to Boy Scouts, to campers in the Palisades, to college professors, to government officials, to cowboys and to plainsmen. He was always his own self. He was always simple and generous. He

was always perfectly natural. As such he won national fame—shall we call it the degree of B. L.—a lover of boys. In 1927 he went to Santa Fé and there he founded the Children's Nature Foundation of the Southwest. Wherever he went he was destined to work for the nature interests of children. * * *

It was in the Park that Uncle Benny's fame was achieved. He will be largely remembered by his deeds which radiated from this center. Uncle Benny drew inspiration from inquisitive boys and standing today in front of this bowlder of gneiss, we will all do well to remember that plain, simple, strong, well built leader who for the humblest urchin around his castle—Kanawauke Museum—had always an answer—simply and pleasantly spoken. Here held forth the pious piper of Kanawauke, who could get more enthusiasm—yes, more knowledge—from the raggiest of ragamuffins. A more fitting place for this tablet, a more beautiful and picturesque site could scarcely be imagined.

Uncle Benny was not content with "doing" nature in the orthodox way. To a red-blooded boy he was like an oasis in a desert. Uncle Benny roughed it. He was always at the Camp Leadership Courses of Teachers College of Columbia University. These courses were held yearly at Bear Mountain, and might well be continued to meet the present great need for outdoor leaders. Uncle Benny could have been enjoying feather beds in Brooklyn but he preferred to sleep on a stone hearth at Bear Mountain Inn. Boys worship such a man.

Uncle Benny never dealt with dry facts. His mind did not feed on uninteresting details. It was this characteristic that made him the hero of the Boy Scouts of America. He never displayed his wares by the lecture method. He was always to be seen in the midst of a group chatting away about some snake, toad, or "creature," as he called them. The chances are that he took them from his flannel blouse or pocket. Perhaps a snake would be drinking water or it might be a rattler.

* * * * * Uncle Benny had traits of that Great Commoner, Abraham Lincoln, who would get up on the seat with the driver of the stage coach to talk with a human being. Uncle Benny would listen to boys. Smoking his pipe, he would bow his head, listen to a question, and probably answer it by another question. He was always surprised at the boy's discovery. "Well, well, well, what do we have here? Where did you find this?" And how often boys want to know! And how they look about for some one safe to approach to ask a question. Sometimes, I am sorry to say, they do not dare ask the adults. They would shy at the "pesky critter" or perhaps in sheer exasperation say, "You write an essay about it." And those boys little realized that they were paying a great tribute to the big fellow to whom they were bringing their treasures.

It is hard to tell what is of most worth in teaching science. Men often err in attempting to draw the line between professional teachers and great teachers. While I hope that it is true that professional teachers may become great, it also remains true that all great teachers have by no means been trained. Some are born gifted. It does seem that although Uncle Benny had great knowledge and a great firmness of purpose, he will be remembered for his ways with boy naturalists. He who has the ability to promote a genuine interest in the same thing in which he has his heart may well be ranked as a great teacher. Uncle Benny's leadership is being carried on by his former disciples such as Bill Carr and Mitzi Brown. May their kind ever increase!

I can see in my mind's eye a great file of boys and girls. They are headed away from the lakes and forests that Uncle Benny loved so well. And in the new forests which they discover I can picture woodland flowers and the American robin, the black-masked raccoon—yes, the brown-patterned milk snake—and, as this band of youngsters catches sight of these wood-folks, they get a thrill, and now they will pause to whisper thanks in just two words, "Uncle Benny."

This is an hour that calls for outdoor leadership. Never have we needed as now to get out in the woods and enjoy leisure. We need Uncle Benny to show the way. Well may we pause this Sunday afternoon on the shores of Kanawauke to dwell upon thoughts of Uncle Benny; to hold up his virtues, which were the simple ones; to get inspiration if we may from an example that ought to be held up for the guidance of youth. In furnishing boys healthy, leisure-time occupation, he saved the state of New York many times money enough to build a monument. He reared in the affections of these boys a far greater monument, more to be prized than any tablet of precious metals in the whole world. What more need be added? We honor ourselves in honoring the memory of Uncle Benny Hyde.

The Bear Mountain Trailside Museum, operated by the American Museum of Natural History, has been carrying on the work started by Uncle Benny so many years ago. It is now under the direction, of Mr. William H. Carr, assistant curator in the department of education, who knew and worked side by side with him constantly during these years. At the unveiling Mr. Carr said:

Benjamin Talbot Babbit Hyde, whom we all knew as "Uncle Benny" Hyde, first came to the Kanawauke Lake region in 1920. For seven years he labored to build a type of educational institution that eventually proved a unique contribution to nature teaching throughout America. Today his work has spread to other lands, and is still spreading.

It is altogether fitting that a memorial to Uncle Benny's work in the East should be placed here, near the log Pavilion, where his Boy Scout Museum was first established.

No one who knew Uncle Benny will ever forget him. His tireless efforts to spread the gospel of nature appreciation and knowledge brought him into contact with men, women, and children wherever he journeyed—and he journeyed far.

His was an inspired life, a life of devotion, of unselfish service in the cause of encouraging children and grown-ups to intelligently enjoy life in the open.

His tastes were simple. He had little use for stereotyped methods of presenting subject material. The keynote in all of his teaching was informality. His abilities as a showman aided in his exhibition work to a very large extent. He had a genius for making ordinarily dull subjects intensely interesting.

A keen sense of humor came to the fore on numerous occasions and often saved the day. Uncle Benny was particularly anxious to encourage people to lose their fear of everyday woodland creatures, such as harmless spiders, toads, reptiles, and a host of others. He discovered that the best way to educate parents was to work through the children. He was enabled to quell the fear of perfectly harmless snakes in hundreds of persons in this way.

Uncle Benny's activities were so numerous and his accomplishments so many that it is difficult to speak of him at all in a few words. The important incidents that entered his everyday life here at Kanawauke were countless. We would like to tell of many of these incidents but cannot at this time. His life was so cheerful, his manner so fine that he became a virtual hero to many of the young campers in the Park. Children would come to the museum door in droves, and the first question asked was usually,

"Where is Uncle Benny?"

I would like to read at this time a few extracts from an editorial that appeared in the *Santa Fé New Mexican* on July 27, 1933. This editorial showed appreciation for Uncle Benny's work in the Southwest, where he settled after having left the confines of the Palisades Interstate Park. It read in part:

"Uncle Benny was eternally a boy, he loved all boys; and they gravitated to him as to a magnet. His life was one of boyish enthusiasm, sweetness, and generosity, of absolutely unselfish work to teach boys the secrets of the out-of-doors.

"Uncle Benny was, in fact, a unique institution.

"Few individuals have done more to build wholesome and manly citizens hereabouts, and there have been no better citizens."

Uncle Benny's foremost success, perhaps, lay in his ability to work with individuals. He spent hour after hour with children who came to him with nature problems to be solved. He was never too busy—never too involved with other matters.

His tolerance and patience were unending. We, who worked by his side for many years, will never cease to be thankful for that friendly, kindly association.

Uncle Benny's influence will be exerted for years to come. He was a modest, honest, and straightforward leader who sought no undue credit; who made no claim to priority for his achievements. He surmounted difficulties that would have discouraged a lesser man, for he was a true pioneer.

His story is still being written.

Dutch Elm-Disease Laboratory

Mr. R. Kent Beattie of the United States Department of Agriculture, principal pathologist in charge of the work on tree disease emergencies, announces that the Bureau of Plant Industry has moved its research laboratory for study of the Dutch elm-disease from Wooster, Ohio, to Morristown, New Jersey, because New Jersey is now the principal center of infection.

The new laboratory is in charge of Curtis May. It is located in the midst of the seriously infected area around New York City, and is equipped to identify suspected specimens collected in any State. The coöperation is urged of all tree lovers everywhere in watching for this disease which menaces the American elm.

Not every sick elm has the Dutch elm disease. Watch your elms for *wilting leaves* or *yellow leaves* or

brown leaves, accompanied by brown streaks in the young wood. If you find this combination, send twigs the size of a lead pencil which show the brown streaks to the Dutch Elm Disease Laboratory, 2 Park Place West, Morristown, New Jersey. There the fungus will be cultured and it will be determined whether your trees have the Dutch elm disease or some other malady. With the specimens, send a statement of the exact location of the tree.

Elm-Disease Exhibit

The "brown streaks in the wood" which people have been asked repeatedly to look for in trees suspected of being afflicted with the Dutch elm-disease are clearly illustrated in a new exhibit installed a few weeks ago in the Museum Building at the New York Botanical Garden.

The specimens of wood have been taken from a tree near the grounds which the Garden authorities cut and burned this month, with the owner's permission, as soon as its diseased condition was discovered.

Also displayed are some of the beetles which carry the fungus disease from tree to tree by transporting the spores on their bodies.

Part of a limb, with the bark removed, shows the breeding tunnels and feeding galleries of the beetles, while other limbs show how the beetles escape by boring a hole through the bark. In a part of the exhibit contributed by the United States Department of Agriculture, beetles are shown feeding in the crotch of an elm twig—one important means by which the fungus enters the wood. Successive stages in the life of the beetle and of the fungus, as well as different types of dark streaks in the wood, caused by the fungus, are likewise shown.

In notes appended to the exhibit, it is pointed out that other diseases possess similar symptoms of yellowing, wilting, and dropping of leaves, and of dark streaks appearing in the wood. It is therefore necessary for a laboratory to make cultures from the infected wood or from the beetles believed to be carrying the disease, to identify the fungus. But once the Dutch elm-disease is discovered, immediate action toward cutting and burning the tree is essential, especially during the season [August] when the beetles are emerging and flying to other trees. Otherwise the disease will be widely spread among the elm trees of the east.

The New York Botanical Garden is coöperating with federal, state, and local authorities in the study and eradication of the Dutch elm-disease.

—C. H. WOODWARD.

Forest and Rainfall

How forests feed the rainfall to the thirsty land, and how the absence of tree and forest ground cover permits the soil and the country to become a prey to alternating flood and drought is shown in the

exhibit of the Forest Service, United States Department of Agriculture, at the Century of Progress Exposition at Chicago. Hundreds of Fair visitors each day show interest in the miniature forested and denuded plots exposed to "rainfall" and watch the contrast in run-off of surface water.

This exhibit, prepared in the Washington office of the Department, illustrates the water absorption power of the forest cover, the water percolating slowly through a spongy mass of forest ground litter, feeding the rootlets of the plants and the springs and streams. Alongside the miniature forest is a bare and burned-over plot which, because the pores of the soil are sealed, is unable to hold the rainfall and put it to work. Instead, it permits the water to run off quickly, causing destructive erosion and floods and permitting only a little of the moisture to penetrate into the hard soil.

New Food for Fishes

Common goldfish, tropical fish, as well as game fish, live longer and grow larger than normal when they are fed a recently developed food made from concentrates of milk in flake and granular form.

This assertion is made by the inventors of the product after a series of thorough tests. They are Robert Roughsedge of The Dry Milk Company, Inc., and Dr. George C. Supplee, director of the research laboratories of The Dry Milk Company, which is one of the Borden Associated Companies.

The new food is already proving to be popular at fish hatcheries. For example, one of the New York State game fish hatcheries is feeding it to the trout it raises to stock the streams of the State. Also, a New Jersey hatchery has made a practice of feeding it to the tropical fish it raises.

Long experiment was necessary to develop a process whereby milk could be kept insoluble in water. By conquering this difficult problem, the inventors have made available for fish the strength and growth-developing qualities of milk. Two secret mechanical processes are utilized in manufacturing the product.

It is said that the new food has many advantages over the ordinary types of fish foods such as cereal or grain basis products or dried or ground liver. The food is high in protein and vitamin content which supplies the fish with a well balanced food necessary for proper nourishment.

Fish fed the new food live considerably longer on the average than fish fed other kinds of food, it has been definitely established. The reason for this is that fermentation and contamination are greatly reduced because the unconsumed food does not decompose and foul the water.

Until recently little study has been devoted to the feeding of aquarium fish or to the many dangers that follow improper feeding. Now it has been proven that more than 75 per cent of the deaths of

fish in home aquariums and pools is due to faulty feeding.

Rapidity of growth is stimulated by the new food principally because it is well balanced and contains only the necessary natural elements.

Another characteristic of the new food is its economy. Due to its high nutritive value, only one-half of the quantity of food usually used at one feeding is necessary. It is unusually light and fluffy.

A physical property of the product, which is not prevalent in other foods is what is known as "surface return" or "refloat." When a small quantity is placed on the surface of the aquarium, the greater part of it will remain afloat. However, a small portion will sink to the bottom and, after a minute, rise to the surface. This "refloat" characteristic reduces the possibility of contamination from particles lodging between stones and sand where it cannot be picked up by the fish.

As many fish fanciers like to feed food of the same shade to their various colored tropical fish, the new food has been prepared in eight colors. The preferred colors are white, pink, and green.

A special medicinal fish food is also being experimented on by Mr. Roughsedge. Tests have shown that certain parasites, which are prevalent in July and August in outdoor fish pools, can be eliminated by feeding with this special medicinal food. One parasite in particular attaches itself to the various parts of a fish's body and gradually saps the fish's vitality until it dies.

These parasites have been a difficult problem for large goldfish hatcheries for many years and it is expected that the new food will solve the problem.

Meetings of Societies

At the International Congress of Anthropological and Ethnological Sciences held in London, July 30 to August 4, the American Museum was represented by two delegates, Prof. William K. Gregory, curator of the department of comparative and human anatomy, and Dr. George Emerson Brewer, research associate in somatic anthropology. Professor Gregory, by invitation of the program committee of Section A (Anatomy and Morphology), presented two illustrated papers: "Man's Place among the Primates" and "The Comparative Aspect of Dentition."

Mr. George Pinkley, James Arthur research assistant in the department of comparative and human anatomy of the American Museum, who has been carrying on his researches in the department of anatomy, University College, London, read a paper on "A New Interpretation of Wadjak Man." This paper was highly praised by the chairman, Sir Grafton Elliot Smith, as an important contribution tending to show that the Wadjak (Java) skull described by Dubois shows evidences of relation-

ships with the modern races of *Homo sapiens*, especially with the Mediterranean race.

At the close of the Congress Professor Gregory made a brief visit to Thurso on the north coast of Scotland, where he was the guest of Prof. C. Forster Cooper of Cambridge University. For several summers past Professor Cooper has been excavating in a quarry not far from Thurso, bringing to light a large collection of the oldest known ganoid fishes from the Old Red Sandstone, of Devonian age. Professor Cooper is reserving a representative series of these valuable specimens for presentation to the American Museum.

Gigantic Glass Front for Museum Group

During the summer two large sheets of plate glass were set into the front of the Coral Reef Group in the Hall of Ocean Life at the American Museum by the Pittsburgh Plate Glass Company. These are the largest plates of glass that have been used hitherto in a museum exhibit, and among the largest that have been set in this city. The glass protecting the part of the group on the gallery floor is the larger of the two, measuring 12 feet 5 inches in height and 19 feet 9½ inches in length. The glass for the submarine portion of the exhibit beneath the gallery measures 10 feet 9 inches in height and 18 feet 11 inches in length.

In order to get these sheets of glass into the Museum it was necessary to remove the doors, door casings, and transoms of the employees' entrance of the east tower, and to construct a special carriage to transport the great sheets through the archway into the Hall of Ocean Life. A special crew of fourteen men were sent to handle the glass sheets, which are now safely in place.

Distinguished Guests

Twenty-two Dutch children, good-will ambassadors to the United States, from the Netherlands, during their visit in New York, were guests of the American Museum at luncheon on Saturday, July 21. Dr. Walter Granger received the party, and Mr. George L. Alpers, advertising manager of NATURAL HISTORY, with the aid of Dr. G. G. Simpson, acted as host. The visitors were in charge of Jonkheer C. L. H. Quarles Van Ufford and Mim Borregaard. During the luncheon, the Dutch visitors presented a plaque to the Museum, which was received by Doctor Granger. They also made gifts of Dutch products to several other members of the staff who were present. After luncheon, in spite

of the hot weather, several delightful hours were spent in viewing the various exhibits at the Museum, including the new African Hall which as yet is not open to the public.

The party of Dutch boys and girls were specially picked as representatives of the Netherlands Government for a twelve-days' visit to New York. While here, they visited many of the points of interest in New York City and environs, including Col. Theodore Roosevelt's birthplace and a day at President Roosevelt's home at Hyde Park. They returned to Holland on July 30, on the "Volendam" of the Holland-America Line.

Natural History Lectures

"Meshie," famous "child of a chimpanzee," will appear in person with her owner, Mr. H. C. Raven, associate curator of comparative anatomy at the American Museum, on November 24 at 11 A.M. at Carnegie Hall, New York City, where she will contribute her share toward the natural history education of young people, under the auspices of the United Parents Teachers Association of Greater New York. This association is giving a series of entertainments on Saturday mornings, beginning October 6, that are planned to meet every interest and age and that will vary from opera to circus, and will also include lectures and films on natural history subjects.

Errata

The model of Tikal in the Buffalo Museum, a detail of which was illustrated in the July-August issue of NATURAL HISTORY in connection with Dr. George C. Vaillant's article on "The Art of Painting in Pre-Columbian Central America" was incorrectly credited in the legend accompanying it. The Tikal Group was designed by Herbert Maier, who also made the temples. The background was painted by Henri Marchand. The figures were made by H. Brainard Wright, and the group was executed under the direction of Carlos E. Cummings, acting director of the Buffalo Museum.

On page 429 of the September issue of NATURAL HISTORY there appeared a photograph of the Standing Rock Indian Agency. This, in the caption, was said to be in North Dakota. We must apologize for the very obvious error. It should have read South Dakota.

Reviews of New Books

Recent Publications For Those Interested in Nature

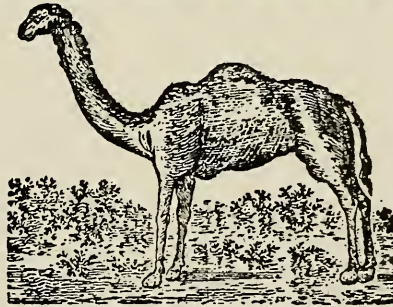
Romantic Copper—Its Lure and Lore. By Ira B. Joralemon. Mining Engineer and Geologist. D. Appleton-Century Company,—249 pp., 1934.

THIS book, which is ably written by a well-known American mining engineer and geologist, gives the amazingly dramatic story of the recovery of copper from the earth throughout historic times. Cyprus, "the island of copper," affords material for the first chapter; the second chapter is devoted chiefly to Spain. In each instance the story of the discovery of copper in each of these places and of the mining methods used by the Phoenecians, Romans, and Moors are contrasted with present-day methods. It is not only surprising to note how much ore was mined prior to the invention of gunpowder and dynamite, but to what extent human labor was used in Roman times as compared with the present-day machine age. Today it is not an unusual sight in the Rio Tinto section of Spain to see the teeth of a power shovel cut through the oak beams implanted in the mines by Roman slaves some 1500 years ago. Chapters are also devoted to the discovery and development of the copper mining industry in the states of Michigan, Montana, Utah, and Arizona. In all of these places the book fully describes the lusty life of the mining towns, the mighty contests that arose between rival miners and companies, and the principal characters that figured therein. The scene then shifts to the present where diligent search for copper has extended into Mexico, Chile, Peru, Australia, and Africa. Copper, the red malleable metal, has afforded a lively story of greed, ambition and miraculous discoveries, of comic rivalries and tragic failures, of steady scientific progress and of battles between industrial magnates.

—CHESTER A. REEDS.

Random Notes on the History of the Early American Circus. By R. W. G. Vail. American Antiquarian Society, Worcester, Mass.

THE author of this valuable little monograph is over modest in calling it "Random Notes," for it is well arranged under the headings Animals, Trained Animals, The Menagerie, Acrobats, Freaks, Indians, Equestrians, these elements uniting at the end into The Circus. The first real American circus, that is, a show with riders, leapers, tight-rope dancers, and a clown, was more or less patterned after Astley's "famous London circus." It was founded by John Bill Ricketts, who came from England in 1792, built a riding school in Philadelphia, and shortly thereafter added a circus as above defined. The author does not make it clear that the modern



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[Abraham was old and well stricken in Age: And the Lord had blessed Abraham in all Things. And Abraham said unto his eldest Sonwert of his House, that ruled over all that he had, Thou shalt go unto my Country, and to my Kindred, and take a Wife unto my Son Isaac. And the Servant took Two Camels, of the Camels of his Master, and departed; and went to Mesopotamia, unto the City Nabor. And he made his Camels to kneel down without the City, by a Well of Water, at the Time of the Evening, even the Time that Women go out to draw Water. Then Hagar directed the Servant, and succeeded him in obtaining the Quiver of the Bowmen, Brethren and Kindred of Rebekkah, that he should go to the Land of Canaan, and become the Wife of Isaac. And they saw every Rebekkah, their Sister, with her Daughters, and her Nephew, and Abraham's Servant, and his Men, and they rode upon the Camels. GEN. 24:1-14.]

AN ILLUSTRATION FROM *Random Notes on the History of the Early American Circus,*
BY R. W. G. VAIL

circus is widely different from its Roman namesake, in which the military and fighting spirit was predominant.

Each of the main constituents of the American circus had independent and sporadic beginnings in Colonial days, and it was not until after the Revolution that the circus sprang rather suddenly into being. At first lion tamers, trained elephants, etc., appeared as individual entertainers; the menagerie, or collection of wild and trained animals, emerged about 1789, but, according to the author, did not combine with the circus proper until about 1822, when James West's company of fine trained horses and riders added a spectacular play with "the elephant and the camel" in the cast.

"Early in the 1820's," writes Mr. Vail, "the American circus was beginning to go on tour and it has been estimated that there were more than thirty on the road at that time. The old shows in their permanent buildings had been too costly, and only those, like West's, which went on the road, made any money. Permanent amphitheatres were too expensive, and canvas-sided enclosures too unsatisfactory because of the constant threat of inclement weather. So it was but natural that Howes and Turner's Circus should have, in 1826, embarked on a long and successful career under a full-top canvas, and with this innovation began the history of the modern circus."

There are many curious and amusing things in the book. The Philadelphia "*Aurora*" of July 26, 1796, stated that "the elephant possesses the adroitness of the beaver, the intelligence of the ape and the fidelity of the dog. He is the largest of quadrupeds; the earth trembles under his feet. He has the power of tearing up the largest trees and yet is tractable to those who use him well." The "Learned Pig" of Boston was "taught to discover the cards, to assort the letters of words, and to bring numbers for any purpose." Quite an intelligence test—of the trainer.—W. K. G.

Some Hamilton Crinoids of New York and Canada. By Winifred Goldring.

This *Bulletin*, (No. 3 of Volume 15) just issued by the Buffalo Society of Natural Sciences describes the new species in the Reimann Collection owned by the Society and gives added information about some previously but imperfectly known species.

One of the species new to science—*Botryocrinus reimanni*—is a new meat-eating sea lily or crinoid and was named by Doctor Goldring after its discoverer, Irving G. Reimann, curator of geology, Buffalo Museum of Science.

Recent American Museum Publications

During July and August the following *Novitates* and *Bulletin* were published by the American Museum:

NOVITATES

- No. 733. List of Chinese Turtles, Crocodilians, and Snakes, with Keys. By Clifford H. Pope.
- No. 734. A New Antilocaprid and a New Cervid from the Late Tertiary of Nebraska. By Erwin Hinckley Barbour and C. Bertrand Schultz.
- No. 735. A New Notoungulate from the Eariy Tertiary of Patagonia. By George Gaylord Simpson.
- No. 736. Some Bees of the Genus *Ceratina* from Africa. By T. D. A. Cockerell.
- No. 737. Some Foraminifera from Western Long Island and New York Harbor. By Benjamin Shupack.
- No. 738. African Muscidae—1. By C. H. Curran.
- No. 739. Further Notes on African Tryptetidae (Diptera) in the Collection of the American Museum of Natural History, with Descriptions of Three New Species. By H. K. Munro.
- No. 740. Frontal Protuberances in Horses. An Explanation of the So-Called "Horned" Horse. By S. Hardestad Chubb.
- No. 741. Primitive *Archidiskodon* and *Palaeolorodon* of South Africa. By Henry Fairfield Osborn.
- No. 742. Two New Mammals from Kazakhstan. By George G. Goodwin.
- No. 743. New Species and Subspecies and Additional Records of North American Anthidiinae. By Herbert F. Schwarz.
- No. 744. *Lovenilampas*, a New Echinoidean Genus from the Cretaceous of Brazil. By Carlotta Joaquina Maury.
- No. 745. New Hesperidiidae from Trinidad and Peru (Lepidoptera: Rhopalocera). By E. L. Bell.

BULLETIN

Vol. LXVI, Art. III.—The Diptera of Kartabo, Bartica District, British Guiana. By C. H. Curran.

Recently Elected Members of the American Museum

SINCE the last issue of NATURAL HISTORY the following persons have been elected members of the American Museum:

Patron

Mr. EDMUND P. ROGERS.

Sustaining Member

Miss JULIA BOURGEOIS.

Annual Members

Mesdames MAX FARRAND, ANNA TAYLOR JONES, LOUIS P. KORNDORFER.
 Misses LYDIA C. DUPONT, CATHERINE DUTCHER, LILIAN RANDALL.
 Messrs. WILLIAM DIEBOLD, JOHN B. DORSH, W. A. FINE, JR., SIDNEY D. GAMBLE, S. M. MEEKER, C. J. STEWART,

Associate Members

Mesdames LOUIS BOURGEOIS, SR., ALTHA E. FOUCH, J. F. LAVERY, JAMES J. LEE, ROBERT R. MILAM, E. C. RAUTENBERG, ISAAC SPRAGUE, E. G. STEELE, EDWIN M. WHITNEY.
 Misses MARY C. ALDRICH, WINIFRED L. K. BAKER, GRACE BOURGEOIS, BARBARA A. LOPEZ, SUSAN W. STREET, DOROTHY T. WIGHT, OPAL C. ZEITERS.
 Doctors RHYNS JONES, LLOYD E. ROZEBOOM, GUMERSINDO TORRES.
 Messrs. CLARENCE J. BECHSTEDT, LUCIEN BOUCHAGE, RICHARD BROOKS, MATALEA BROWN, SIGMUND BURGER, DONALD T. CARLISLE, C. W. CARSON, JR., JOHN JUDSON CHAPMAN, GEORGE M. CHESTER, LAURENCE S. CRITCHELL, JR., ALBERT ELLIS DOWARD, A. G. ELBON, MAX E. ESTERNAUX, JR., WARD G. FOSTER, CHARLES A. GREENFIELD, GODFREY HAMMOND, ROBERT HANNAH, HAYS JOHNSON, HENRY M. LANE, J. B. M. MAGEE, W. B. MORTON, ELIE NADELMAN, GEORGE B. PACKARD, HARRY PANISH, M. K. POVLSEN, A. J. SARDONI, W. E. SAUNDERS, ARTHUR SCHACHNER, W. H. TAYLOR, CLARENCE A. WEGEL



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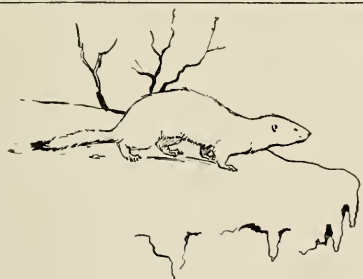
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The Guide to the Hall of . . . Biology of Mammals

BY ROBERT T. HATT

is one of the Museum's latest additions to its Guide Leaflet series. This very compact booklet is more than mere description of an exhibition hall; it serves, as well, as an introduction to the major groups of mammals and their outstanding biological characteristics. In fact, it does not at all depend upon the exhibit for its usefulness and interest. The frontispiece, entitled "The Family Tree of Mammals" is only one of its many fine illustrations.

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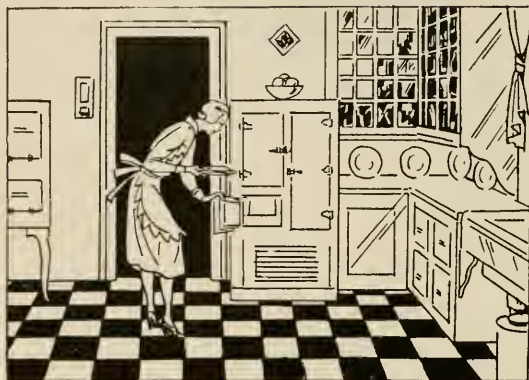
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
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The Journal of the American Museum of Natural History

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Lion
and
Lioness

The handsome male in this photograph is said by Martin Johnson to be "the largest and finest" that he has ever seen. Both animals watched the photographer with interest while motion and still photographs were being made, and even consented to growl a little, so that an excellent sound record was made on the film

NATURAL HISTORY

November, 1934

Wings Over Africa

by
Martin Johnson

An account of a photographic expedition that traveled
by airplane through 60,000 miles of African sky

HAD I been told, three years ago, that on our next expedition to Africa we would fly our own airplanes for 60,000 miles over the jungles and lakes and plains of the once "dark" continent, I would have been convinced that my informant was mad. Yet that is what happened, despite the fact that until so short a time ago I had what I imagined to be a definite and deep-seated aversion to flying.

My change of mind came about quite unexpectedly. Called to Kansas from New York by the serious illness of my father, I went by the quickest possible route—which was, of course, by air. So expeditious was this means of travel, and so simple and pleasant, that I found myself keenly interested in a subject which theretofore I had never imagined would appeal to me. My next step was to learn to fly, and, after that, to talk Osa (my wife) into learning. Even yet, however, we had no idea of purchasing planes for use in Africa. But then, on a visit to Bridgeport, Connecticut, we went out to the Sikorsky plant, as a matter of curiosity, and, though we did not realize it at the time, we saw the planes we ultimately took with us.

Weeks passed before we really admitted to ourselves that we wanted them, but as I look back now, I see plainly that the die was cast on the occasion of that first visit to the Sikorsky factory. At any rate, when we sailed from New York, in December, 1932,

for Cape Town, we had with us on the ship two Sikorsky amphibians by means of which we were determined to carry our expedition supplies and ourselves first from Cape Town to Nairobi, and from there to many interesting spots in the outlying districts that theretofore had been, very often, so hard, or even impossible, to reach in the time at our disposal and with the equipment that our task required.

There were eight in our original party, for photographic expeditions have grown more complicated for other reasons besides the addition of airplanes. Had I been forced, for instance, when I first started to handle the crank of a motion picture camera, to learn the complexities of "sound equipment" as well, I might—and with reason—have considered the matter beyond me and turned to simpler pursuits. But having fairly well mastered "cinematography" before sound photography was added to an already reasonably complicated procedure, I merely buckled down and attained a fair understanding of this newer and more complicated business. But now, as if motion picture cameras and sound equipment were not enough, I was adding aviation for good measure.

Nevertheless, cameras, sound apparatus, and airplanes together are a little too much for two people to handle satisfactorily, and while Osa and I, on our earlier expeditions, have gone into the field with no assistance beyond what our native "boys" could be



Airplanes

The large photograph shows part of an assemblage of pygmies in an opening in the Ituri Forest, as they danced around the Johnsons' plane—the first that they had ever seen. Thirty-six of these little people were taken up at one time in the big "ship." The picture at the lower



and Natives

left shows the plane after it had landed in a narrow opening among the trees, where careful handling was necessary both in landing and in taking off. The picture at the lower right was taken in the Kaisoot Desert, among the Somali people who examined it with interest



depended upon to deliver, we now required two competent pilots, and two men equally competent to handle the sound apparatus. The result was that in addition to Osa and myself our party also included Boris Sergievsky and Vern Carstens, our pilots, and A. J. Sanial and Robert Moreno, our sound engineers. As a matter of fact, there were others as well, though some were scheduled to go only as far as East Africa. Boris Sergievsky, for instance, had other contracts to fulfill, while Al Monvay, our mechanic, had to return to the Sikorsky factory, and Arthur Sanial had to return to the United States to carry on his work in "sound" engineering. But when our planes had been assembled in Cape Town and took off from the ample waters of Table Bay, we formed a party of considerable dimensions.

PLANS

I am invariably asked, before we start on any expedition, just what our plans are. The truth of the matter is that detailed plans are rarely on our calendar. Our purpose is to make the best possible motion pictures of animals and natives, and in order to do that we have long since learned that we must take advantage of conditions as we find them.

Consequently, almost our only main purpose on our last expedition was to be prepared, both with equipment and with transport, to do this although, with planes at our disposal, we did look forward to visiting Lake Rudolf, an immense body of water which extends from Abyssinia far into the northern part of Kenya Colony.

But it is necessary to say that our purpose never was to photograph animals from the air. Effective animal pictures must be from reasonably short distances, and, too, they must, for the most part, show undisturbed and comparatively tranquil scenes. These cannot be obtained from the air. But airplanes are useful in looking over the land, and they make possible the most remarkable speed in a land so largely devoid of roads.

But we did more than use our planes as means of transportation. With fixed camps,

where repairs could be made and where supplies could be kept, we often sailed off "into the blue" with our planes so equipped that we lived aboard as comfortably as if we had been on a motor cruiser or a small yacht. Then, with the larger of the two (it is a 10-place plane) as the "houseboat," and the smaller 5-passenger plane with which to do our "scouting," we had no need to pitch camps or to go equipped with all of the paraphernalia that the usual safari requires. For a few days we were thus able to live in perfect comfort hundreds of miles away from our base camps. Both planes, being amphibians, can land either on the plains or on the rivers and lakes, though often we had to fly back and forth over our chosen landing places many times in order to clear the place of animals among which we might otherwise have had a rough, or even a calamitous, landing. The ponderous back of a hippopotamus or a crocodile in a lake or a river offers all the elements of danger to landing that a rock might offer, with a few others thrown in for good measure, and a beautifully level section of the plains is literally filled with possibilities of unfortunate landings if antelope and zebra and giraffe abound. Thus a certain amount of care is necessary in order to eliminate a danger that is not so often found elsewhere in the world. It is only fair to our planes and to Vern Carstens, however (and incidentally to Mrs. Johnson and myself, for we flew the planes ourselves more than a little), to say that in our sixty thousand miles of African flying, during which we landed in scores and scores of unprepared spots, not once did we have any difficulty that even remotely suggested a "crack-up."

It was interesting, too, to see the result of landing a huge and roaring plane near some native village to which, theretofore, an airplane had been a thing unknown. To expect them to show keen interest or even fear was, I suppose, natural enough. But to come down, as we did, quite unexpectedly on Lake Rudolf, and to be received, and even aided, by natives to whom airplanes were utterly

In Camp



Ready for
a Flight

The Johnsons' planes are shown parked at a camp on the side of Mt. Kenya, ready to take off for a flight in any direction on the receipt of news from the natives of the movements of game

Mountain, Lake,

Left: Mt. Kenya among the clouds, as it appeared from an altitude of 18,000 feet. So rarefied was the air at this height that even the winding of a spring-driven camera left Mr. Johnson almost exhausted

Below: Landing a plane in a Kikuya village. Immediately after this picture was taken, one of the huts collapsed, due to the fact that too many of these frightened natives chose it as a shelter



and
Plain

Right: The rugged, barren shores of Lake Rudolf, a most dangerous region in the event of a forced landing



unheard of, and then to see that they paid absolutely no attention to the great planes, which were the most apparent objects in sight, was, I must admit, a surprise to me. In one place, where there were no trees and where no shade gave relief from the broiling sun, these natives crouched in the shade of the wings when we had beached the plane, and showed not the slightest interest, otherwise, in it. Even when Vern Carstens took the plane up and circled over our heads these strange Turkanas did not so much as look up to watch him as he flew.

Yet, on another occasion, we took up thirty-six pygmies while we were on a visit to the Ituri Forest, in the Belgian Congo, and a more delighted and highly pleased group I never saw.

PYGMIES IN AN AIRPLANE

Since my first visit to the pygmy country six or seven years ago I have been a great admirer of these delightful little people. In the twenty years or more that Osa and I have spent so largely among savage and primitive peoples, I never have come across more likeable natives than these little fellows of the Ituri Forest, and it was with more than a little interest that I looked forward to introducing them to our air-planes.

We sent a party ahead in order to have a landing field prepared in a clearing we remembered, and when we had given them time to reach the place, and to remove the ant hills and other obstructions to landing, we followed. The signals that were set out for us told us the field was ready for our reception and we landed without the slightest difficulty, to find almost two hundred pygmies awaiting us.

We had only a few days at our disposal, and I set about inviting a group of the little people to take a flight with us, but my invitation failed. They did not refuse, but neither did they accept, each of them smiling and shrugging his shoulders, suggesting by signs that his nearest neighbor was a likely prospect. So presently I gave up the invitation

method, and proceeded to round up a group, directing them into the plane.

The chief and his wife definitely refused to go, but I managed to include two of their children—tiny little girls about fifteen years of age. They were especially bright little things, and I wanted them in the party. Neither of their parents seemed overly delighted, but neither did they object, so, with the cabin literally alive with the excited little people, we took off.

Never have I seen a more delighted crowd. They jabbered constantly, and pointed excitedly out of the windows at landmarks they recognized. When, however, after fifteen or twenty minutes in the air, we passed over a large hill, they grew more excited than ever, and I tried to learn the cause. After some linguistic difficulties the reason for their excitement was explained.

It was their custom, occasionally, to visit that hill, in order, I gathered, to collect herbs or something of the kind, and it always took them two days to reach it through the forest. Yet we, in twenty minutes, had flown that distance, and in another half hour had visited still other "distant" places. It is no wonder they were excited. But when we had returned, and landed with a rush and a swoop, I learned something new about natives.

So interested had I been in the reactions of the pygmies in the plane that I had given no thought whatever to the reactions of those we had left behind, but, when, having landed, we opened the doors and turned loose our thirty-six happy and excited guests, I was amazed to see the chief's wife—the mother of the two little girls we had taken—run fearfully forward. She sought out her children and hugged them. She chattered and wept and kissed them repeatedly, fondling them and patting them, eager to reassure herself that they were safe and sound and whole.

Never before had I seen natives kiss each other. Never before, in twenty years spent largely among such people, had I seen such obvious signs of affection. That natives



Above: Two rhinos, undecided on what course to pursue as an airplane flies overhead, are photographed by Mr. Johnson



Right: A fine specimen of a female elephant. Note the slender tusks, differing so greatly from the thicker and heavier tusks of the male

Below: A ground monkey whose curiosity brought him close to the camera



almost always treat their children well, I knew perfectly, but not until that moment had I given a thought to the frightened mother who had seen her children disappear into the interior of the huge and noisy plane—had seen the thing sweep away with a roar and a cloud of dust—had seen it mount into the heavens and disappear so quickly beyond the horizon. What her fears were no one can imagine. She knew nothing of the possibility of engine failure or of conceivable airplane tragedies. Yet certainly she had been afraid—so much afraid, in fact, that in her relief at seeing them safe and sound once more, she showed all too plainly that mother love among the pygmies of the Ituri is no different from the mother love to which we have grown accustomed here at home.

Among our own black "boys," some of whom have come to be fairly competent mechanics, there was no enthusiasm for flying. They would go up when we told them they had to, but on several occasions they chose to walk 150 miles or more to Nairobi rather than fly that distance with us in less than two hours. They knew enough of motors to know that motors sometimes stop, and they had no desire to be in the sky with such a possibility prominent in their minds.

But this should not be an airplane story, for the airplanes, with us, were incidental to animal photography.

LIONS

We photographed animals in the Be'gian Congo, in Uganda, in the Sudan, in Kenya and in Tanganyika Territory, but the part of it that Mrs. Johnson and I enjoyed most was our visit to the lion country of Tanganyika Territory where Mr. and Mrs. F. Trubee Davison were our guests. They had come to collect elephants for African Hall at the American Museum, but no visit to the game fields of Africa could possibly be complete without including a call on the "friendly" lions of Tanganyika.

As has often been explained, lions show no fear of, and very little interest in, automo-

biles, and apparently they do not differentiate between the people in the cars and the cars themselves. Certain it is that in a car one can approach whole groups of lions far more closely than would be possible if one were afoot. A lion will generally sit or stand almost apathetically as a car approaches, and will even yawn, sometimes, in your very face, whereas he would bolt abruptly, or charge, were a person to attempt to walk toward him.

Osa and I, of course, had seen all this time and again. I have taken literally thousands of feet of motion pictures of such lions. As a matter of fact, the cars I use for such work have movable tops, in order to make it possible for me to stand up and "crank." In this position I am plainly visible from my waist up, yet the lions still do not seem to recognize the fact that I am not a part of the car. Were I to step to the ground, however, they would know quickly enough, and I should have to be prepared for either a charge or a bolt.

But while Osa and I had gone through this experience scores of times, the Davisons had not, and I have yet to see the person who, the first time he sees a wild lion in the open, is willing to be too intimate. The first time we took them out, for instance, we paused at a distance of 150 feet or more from some lions we had located, and when I urged Osa, who was driving, to move up closer, Mr. Davison almost angrily objected, obviously under the impression that I was trying to "show off." Yet, after a few days in the field, Mr. and Mrs. Davison drove off alone one morning, and when, after doing some work around camp, Osa and I followed, we found they had driven up so close to a handsome lion that the radiator of the car interfered with the photograph Mrs. Davison was trying to get, with the result that she was standing up and leaning forward precariously, intent only on obtaining a "close-up" of the lion, which surely was within fifteen feet of the car.

Such "hunting" is, after all, quite the most appealing. It is unfair to drive up to



Leopard

These handsome cats are notoriously difficult to photograph, owing to their nocturnal habits and their rapid movements. This fine specimen was photographed on the slopes of Mt. Kenya

Many journeys easily made by air would have required so much time by other means of travel as to make them highly impractical



Martin Johnson making motion pictures from the larger of the two airplanes. For the most part, however, the planes were used merely for "scouting" and for transportation





Among the Clouds

The Johnsons' planes in the vicinity of Lake Rudolf. In four hours this great body of water could be reached from Nairobi by plane, though on foot the journey would be a matter of weeks and in an automobile it would be foolish to attempt the journey



In Kenya Colony

The larger picture was taken at the camp established in the Northern Frontier country. The two natives had come to camp with a supply of goat's and camel's milk. The smaller photograph shows Mrs. Johnson fishing for trout near their Mt. Kenya camp, where, at an elevation of about 7000 feet, the fishing was excellent and the game plentiful



the unsuspecting creatures and blast them into "kingdom come" with a rifle. And a lion skin, after all, is no such trophy as a thousand feet of close-up motion picture film. The result of the Davison's lion "hunt," therefore, was that the lions remained unhurt while we finally drove off with our ammunition intact and only our film expended.

There are animals, of course, that are not so easy to approach. And in our efforts to make sound records to accompany our pictures we have met with all sorts of difficulties. Many sounds are rarely to be encountered except at night, and an infinite variety of conditions affect the sound record. The wind, for instance, often sighs and whistles so loudly in the sound record as to ruin otherwise good animal sounds. On one occasion, too, the insects that flew against the sound mechanism ruined the record by the popping sounds they added.

LEOPARDS

On the other hand, we occasionally had a piece of exceptionally good luck, such as favored us in the Northern Frontier country when we unexpectedly obtained an excellent series of pictures and a perfect sound record of a leopard.

We had found a small stream in this mostly dry region not far from which, on either side, stood a low and abrupt cliff. The land beside the stream was level and well dotted with trees and shrubs, among which the animals found a comfortable place in which to live. From cliff to cliff, across this level stretch was, perhaps, half a mile, and from the vantage points that could be chosen on either cliff one could train a camera on the open spots in which the animals occasionally were to be seen.

We set our cameras up, therefore, in the best spot we could find, and took our sound recording apparatus out into the level ground below, connecting it with our equipment by a long wire. Hardly were we ready when a beautiful leopard, all unaware of our

presence, appeared in the sunlight well within range of our cameras.

I began cranking immediately, of course, and having obtained an unusually good series of exposures, beckoned to one of our black "boys" who clung to the cliff near by. From long experience, he knew what was expected of him, with the result that he stood up and shouted. Instantly the leopard tensed and snarled. Then, seeing the shouting fellow, the animal charged. Straight toward the cliff he came, while I still cranked. Up the steep rock he leaped, clawing and snarling as he came. For fifteen feet or so he scrambled up, only to slip and slide, still snarling, to the bottom. Again he tried, but by now less determinedly, and, sliding to the bottom once again, he gave it up. Turning back his lips and snarling once more, he stared upward for a moment, and then turned away and disappeared among the bushes.

It may seem in the telling that that is not very much, but leopards are hard to photograph. They are mostly nocturnal animals—small, very rapid, and unexpected in their movements. Thus it was distinctly an accomplishment to obtain so clear a motion picture with the sound record to go with it.

Our work in Africa has come, after fourteen years, to be a round of experiences forever similar to and different from earlier experiences that we have had. When we were new to the work, the unexpected was forever happening, but that is less true now. We have had experiences with most of the different animals and understand them better than we did, and the same is true of the natives. Consequently, though unexpected things are bound to occur in such a task as ours, they are rarer, now, and even the unexpected has about it less of the surprising. We do not feel that Africa is a land of danger. It is, instead, a delightful land, filled with the most appealing of natives and animals, among whom, now, we feel most pleasantly at home.

Gold and Silver

The probable effects on the production of the "noble" metals of present-day monetary theory and practice

by

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DOMESTIC and world policies and theories regarding the functions of gold and silver as money have recently enhanced public interest in them, although they have always been social leaders among the metallic elements. They have long been referred to as the "noble" metals, albeit it is a bit uncertain whether they won the appellation through their relatively high resistance to corrosion, or because law and custom have generally provided that gold and silver deposits should belong to the supreme ruler of the country, rather than to the local land-owner or their actual discoverer.

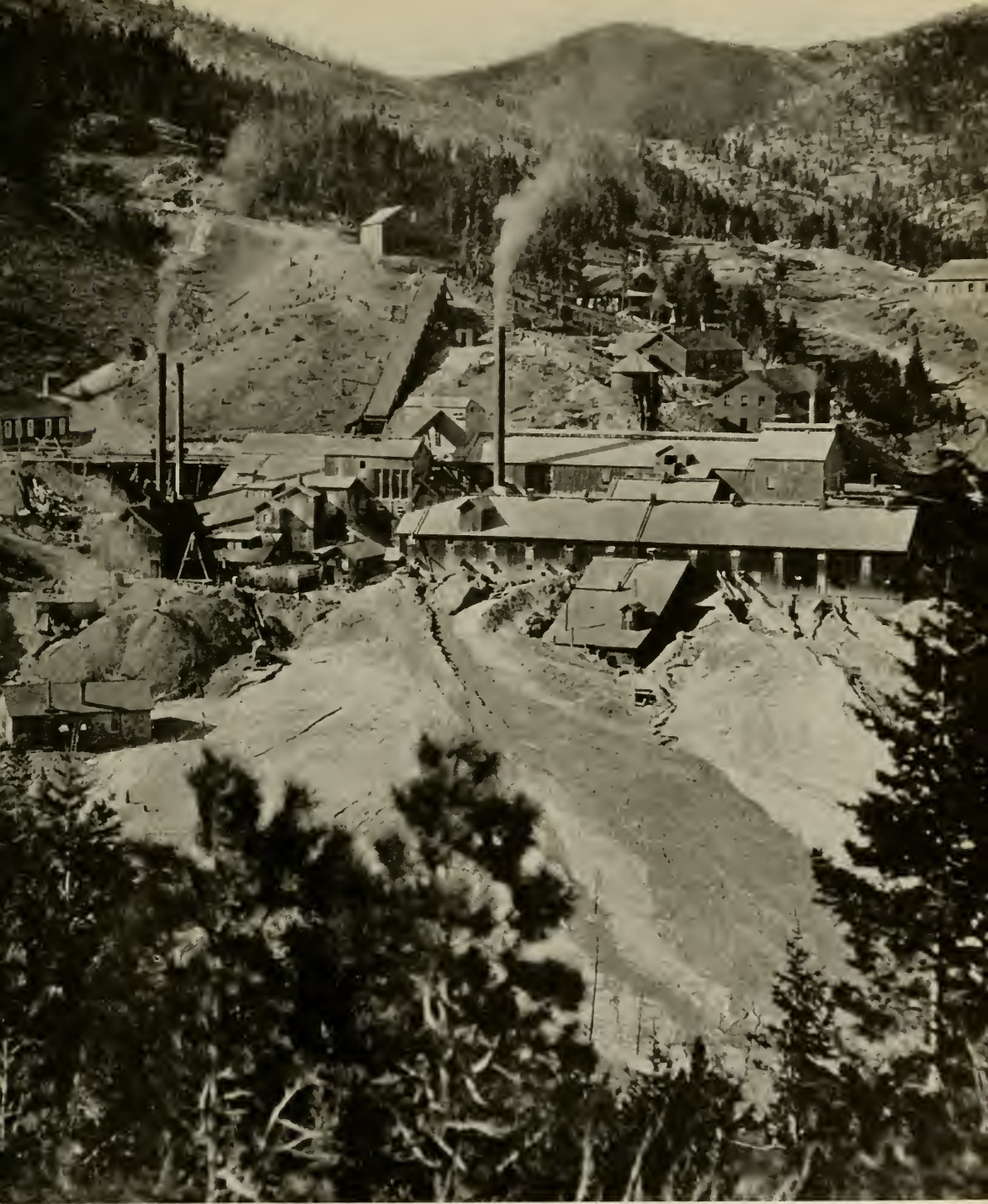
Gold shares with platinum the distinction of being the only metals that are customarily found in nature in the metallic state; nearly all the others typically occur in compounds. Silver divides with copper the honor of occasionally being found in large metallic masses, though most of the world's stock of these two metals has been derived from compounds. Only a few other metals are ever found in the metallic state, rather rarely, and in only small amounts, whereas gold is seldom found in any form except the metallic one. A few tellurides are the only natural compounds of gold that are known, and were it not true that they occur in large amounts at Cripple Creek, Colorado, they, too, would have to be rated as rather rare.

In spite of the fact that there is an easily observable relationship between the size of the particles in which gold occurs in nature, and the ease with which it is collected, we really have very little definite information about it. I hesitate to say which was the

largest piece of gold ever found, lest the statement should be challenged. It does not really matter, for very large pieces of gold are rare, and it will suffice to say that only two or three weighing more than a hundred pounds each are known. And, of course, it would be impossible to establish which was the smallest piece of gold ever found, though that honor probably belongs to some of the particles described by T. H. Hite, in *Economic Geology*, Vol. 28, pp. 686-691 (1933), who reported that gold particles so small as to weigh only a billionth part of an ounce were "abundant" in the sand from the Snake River, Idaho, which he examined with a high power microscope, while particles as small as a ten-billionth of an ounce were "sparingly present."

The answer to the practical question as to how one would collect such small particles of gold is that it is very difficult. Gold is five or six times as heavy as most of the minerals that are its common associates, and if the gold particles are even as large as a poppy seed, it is not at all difficult to "pan" the gravel and collect the gold in the bottom of the pan. Huge dredges elevate gravel and pass it over riffled tables, the gold collecting behind the riffles; perhaps only one ounce is caught for every three hundred tons of gravel handled. But the small particles are difficult to catch, since they are so light that they tend to float in even a slowly-moving current of water; they often seem to have adsorbed films on their surfaces, and perhaps carry electric charges.

The saving of fine gold has not only always been a problem of the placer miner, but also the principal cause of labor for the quartz miner. Agatharcides, writing in the Second Century B.C., described the infinite labor with which Egyptians reduced gold ore



Ewing Galloway

Gold and platinum are the only metals customarily found in the metallic state. Silver and copper occasionally are so found, but Nature supplies us with very few others of which this is true. So finely divided, however, is most of the gold in the world deposits, that particles as small as one ten-billionth of an ounce are not unknown, and only two or three nuggets weighing more than one hundred pounds have ever been found. The Montana mine, shown in this photograph, is representative of many of the mines in the Rocky Mountain region

Gold

Pub. Photo Service

Around the Homestake Mine, at Lead, South Dakota, could be written one of the most dramatic stories of gold mining. Gold valued at more than \$250,000,000 has been taken from this one mine



Below: Silver is so commonly found with other metals that it is often merely a by-product. This Colorado mine produces both lead and silver. Many copper mines also produce some silver

Ewing Galloway





Ewing Galloway

Above: The refining plant of a Sardinian silver mine. Sardinia produces some millions of dollars worth of silver annually

Ewing Galloway]

Right: A silver mine at Pachuca, Mexico. Mexican silver mines are numerous and many of them are unusually productive



Below: The Rand is the world's most spectacular gold producing area, and South Africa, consequently, leads the world in gold output. The view below is of the "Robinson Deep Mine"

Pub. Photo Service



to a fine powder so as to set the gold particles free, in order that they could be recovered by washing. Under the slave system, where labor was supposed to cost nothing because one slave could produce enough food for two, this expenditure of effort scarcely mattered, but, with the abolition of slavery, there arose the question as to whether the value of additional gold recovered by the expenditure of more labor was more than the cost of recovering it. This basic condition was obscured by two facts. Until after 1850 most of the world's gold had been derived from placer deposits, and nobody knew how much gold had not been collected, only what had been obtained. Then, too, the increase in production resulting from new discoveries was so much more important than improving the recovery from ores, that no one except the operators of quartz mines was much concerned about the proportion of the total gold recovered. The gold won during the Sixteenth and Seventeenth Centuries was almost certainly more than had been secured in all human history previous to that time, and the amount added to our stock between 1850 and 1900 was eight times the quantity obtained in 1800-1850.

EARLY INVENTIONS

Nevertheless the producers of gold from ore had long been exercising ingenuity to decrease the cost of pulverizing the ore and to increase the recovery of gold from the resultant powder. Before the Middle Ages they had invented the stamp mill and learned how to operate it by water power; for hundreds of years there was no great advance in the crushing process, only gradual improvement in the design of the stamp mill and the materials of which it was constructed. Sometime after 1850 an unknown inventor substituted flat sheets of copper with their surfaces covered with quicksilver for the inclined tables covered with riffles or blankets to catch the gold. The agitation of the crushed material within the stamp battery operated to clean the surface of the

gold particles, and any that were heavy enough to sink to the quicksilver surface instantly dived beneath it, like a duck into water, and were there safe from the tendency of the flowing water to carry them along. The largest particles of gold did not pass through the screen with which the front of the battery was provided, and were removed from within it, by hand, at frequent intervals.

THE NEED FOR NEW METHODS

The only way to force the stamp mill to yield a very fine powder was to provide it with a very fine screen; a fine screen not only decreased the amount that could be crushed daily, but also gave trouble by clogging and wearing out quickly. Tests on the material running off the end of the table revealed that, while there was still some gold in the larger particles of quartz, it was mostly in the particles of sulphide minerals that occurred sparingly in the ore. So new devices were invented to separate and save these sulphide particles, and they were sent to smelters whenever their gold content was high enough to pay for the cost of the treatment.

Before the middle of the Nineteenth Century various means had been tried to recover the gold from these sulphides without smelting, the most successful being the use of chlorine, but even that was so expensive that the margin of profit was small. About fifty years ago the problem became acute, because the greatest gold field of the world's history, the Rand of South Africa, was discovered, and there half the gold was in particles smaller than 0.05 millimeters in diameter. It was easy to collect the half of the gold that was in the coarser particles, but the finer material was so baffling that it cost more to recover than it was worth.

Whenever an important problem arises, someone comes forward with a solution for it, and the solution in this case was a dilute one of potassium cyanide. By leaching the crushed ore with water containing a few pounds of potassium cyanide per ton, the fine gold particles were dissolved, and by

passing the gold-bearing solution over zinc shavings, the gold was precipitated on them. This method gave rise to a whole bevy of new problems, for the finest crushed material, called "slime," would not permit the cyanide solution to percolate through it in the vats, and had to be separated from the "sand." Nor was it easy to separate the gold-bearing solution from the slime, and great ingenuity was applied to inventing improved filtering devices and finding out how to wash the gold-bearing solution out of the slimes without diluting it to such a degree that it was expensive to handle and could not be reused after the gold had been precipitated from it. Soluble substances in the ore also gave trouble, but in one way or another most of these difficulties were surmounted, and the cyanide process provided a cheap and effective process for recovery of fine gold from ore. Nothing better seems likely to be devised. Incidentally, the increased knowledge thus obtained through the large-scale handling of dilute solutions and of finely divided solids proved useful in the most unexpected ways. It not only brought about a tremendous advance in the whole general subject of hydrometallurgy but, for example, a company that began operations thirty years ago in building improved devices for handling gold ore now does a large business in supplying equipment for sewage treatment.

"FROTH FLOTATION"

Only one major improvement was still to come; the application of froth flotation to gold ores. First applied to the saving of fine particles of metallic sulphides in a froth produced by agitating the crushed material with water, air, and the right combination of a little oil and enough chemicals to secure the most effective hydrogen-ion concentration in the solution, it was found it would collect the small particles of gold as well as the particles of sulphide in which they were locked up. Nearly all the fine gold in the ore could thus be cheaply collected in a relatively rich "concentrate" that was

less expensive to treat than the whole mass. As a result the time-honored amalgamated plates are going out of use except in a few places where local conditions favor their use. In some places it is also more economical to smelt the concentrate than to cyanide it. Gold recovery practice, that twenty years ago was almost stereotyped, has become decidedly diverse.

WEAR AND COST

One diversity is in the equipment used in crushing the ore. The standard stamp mill remains in use in mills already built, but no one would put it in a new mill, for cheaper and more effective grinding devices are now available. But fine grinding will always be relatively expensive. Our stomachs are able to digest food without digesting themselves, but any machine that grinds ore inevitably wears away its grinding surfaces.

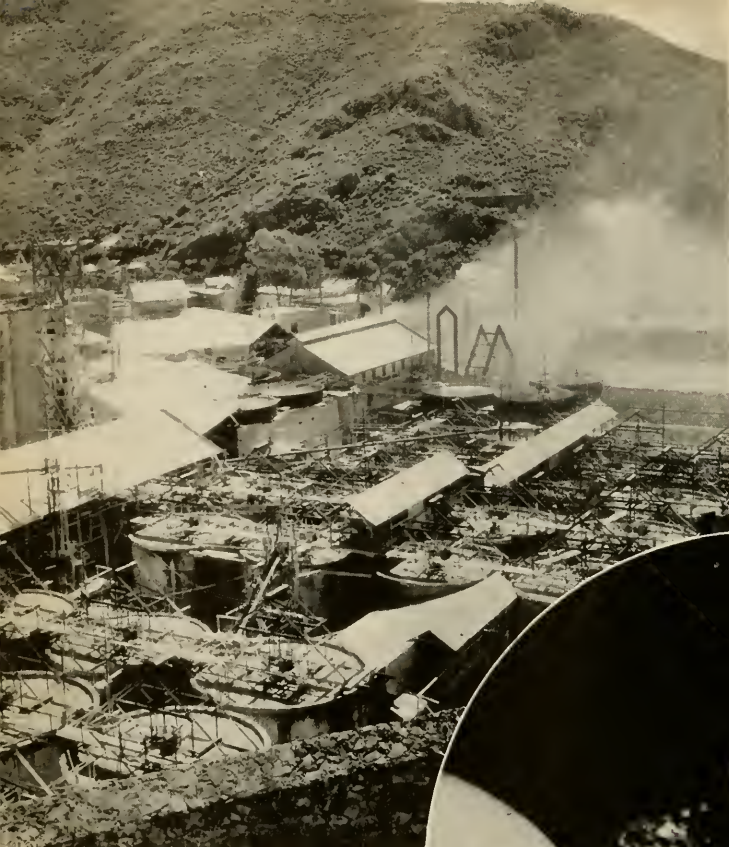
The gold recovered from placer deposits, which until recently was an important fraction of the total, is now rapidly declining, and most of the world's new gold comes from ore that is mined and crushed. The earth's surface has been so thoroughly explored that it seems unlikely that large new placers will be discovered, except possibly in northern Siberia, and most people doubt the possibility of their being found there. Soviet Russia has declared that it is going to increase its gold production to the point at which it will rival that of South Africa, which in recent years has furnished about half of the annual world output of new gold. Gold production in Russia has been somewhat increased in the past few years and, in a Soviet economy where the cost of production of anything urgently needed scarcely matters, can probably be further increased, but most people who are familiar with the practical considerations involved feel that the hope of its ever rivalling South Africa's output is only a dream.

Those who are optimistic over the future of gold production (and there are many optimists) point to the enormous increase in Canada's gold production in the last twenty

Left: Cyanide tanks at Hidalgo, Mexico. In the cyanide process, the gold or silver particles are dissolved, after which the solution is passed over zinc shavings, upon which the precious metal is precipitated

Circle: A five-pound gold nugget mined in Plumas County, California. Such nuggets are far from common

Ewing Galloway



Below: An Alaskan placer mine. By playing powerful streams of water upon them, the gold-bearing gravel and sand are washed through sluice boxes in which the gold, to some extent at least, is trapped

Ewing Galloway



Ewing Galloway

Right: Gold-bearing ore in a California mine, five hundred feet below the surface. Mines in South Africa have been worked to such enormous depths that the heat of the shafts must be counteracted by forced ventilation

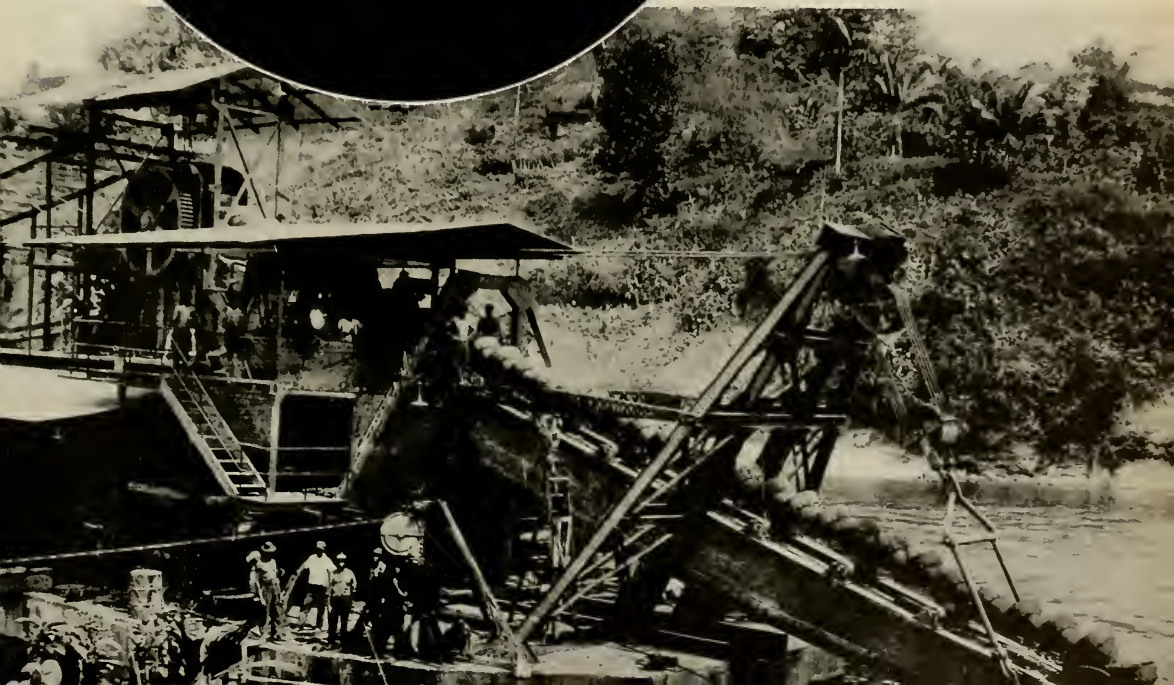
Circle: Silver ore. Occasionally found in metallic form, silver more often appears in combination with sulphur, arsenic, antimony, etc.

Ewing Galloway



Below: A South American gold dredge. So efficient are these enormous machines that they can sometimes afford to handle three hundred tons of gravel in order to recover one ounce of gold

Ewing Galloway



years. The pessimists point out that Canada's 1933 production was only a small fraction of that of South Africa, where production must inevitably decline as costs of mining increase with increasing depth; some of the mines are already more than a mile deep, and the air circulated through them has to be mechanically cooled to reduce the temperature so that men can work effectively at such great depths. The cost of mining the ore is the "neck of the bottle" since it is typically several times the cost of the gold recovery process. There is little hope of making any further large saving in the cost of gold recovery and, unfortunately, nothing immediately apparent as a possible way of much decreasing the cost of mining. The Alaska-Juneau is an outstanding example of a gold mine with a very low mining cost, but the main reason for that is the natural conditions that exist there; other mines cannot copy its methods and obtain equally low costs.

THE SLIGHT EFFECT OF THE PRICE CHANGE

So long as the price of gold remained legally fixed at \$20.67 per Troy ounce it seemed evident that sometime in the future new gold production would decline toward the vanishing point, since the necessity of working at continually increasing depths, and treating lower grade ore as the richer deposits became exhausted, would eventually result in its costing more than \$20.67 to produce an ounce of gold in most places. That eventuality has been postponed by enactment fixing the price of gold at \$35 per ounce in the United States. The reason for that was to influence prices and international exchange rather than to stimulate the output of gold. While it has encouraged many people to attempt to reopen old mines and re-work old placers, these have mostly been newcomers to the field of gold production, and the established companies have not typically greatly increased their output. Some of them fear to invest capital in increased output, for a price that is arbitrarily increased by agencies outside their

control can be as arbitrarily decreased. In some places new taxes have been imposed so the higher price does not yield a correspondingly higher profit, and some companies have thought it wisest to decrease the grade of ore mined so that the annual yield in dollars, and therefore the operating profit, remains about the same as before.

FUTURE OUTPUT

Possibly the 1934 gold output, measured in ounces, will be less than in 1933, though valued at a higher rate. The working of lower grade ores will eventually yield a greater cumulated total of ounces, for a good deal of ore that at the \$20.67 price would have been left in the ground will be taken out and sent through the mills, where its gold content will be recovered.

The technical argument as to how soon the world's output of gold, which in 1933 reached a maximum, would begin to decline was rather like an argument as to whether a sixty-year old man would die in the next decade, or live to be over a hundred. At least, it was like that so long as the price of gold was legally fixed and regarded as unchangeable. Sometime output must decline and in the distant future probably become quite small, though the time when it would completely cease would be long, long in the future. Changing the price of gold has changed the technical situation, and while it is difficult to prophesy exactly what will happen, it seems clear that the beginning of the decline has been postponed, and the total quantity of new gold that will be obtained will be increased. So far, in the United States, the increased price has brought into the Mint more old gold (from old jewelry, gold fillings, etc.) than new. Only a little over half of the gold produced since 1492 is in central banks and other monetary stocks; no one knows exactly where the rest of it is, though we can guess from the gold-plated articles, gold-lettered signs and books, and the gold fillings in teeth that are seen all about us. The gold fillings that are buried with deceased

persons probably represent the most significant way in which gold, once obtained, is permanently lost. It can be recovered from most of the other uses, when and if it becomes worth while.

ECONOMIC AND INDUSTRIAL NEEDS

Whether it is necessary to have a continuing supply of new gold to permit the world's business to function properly is a matter for bankers and economists to debate. But a mining engineer may be permitted to have an opinion on the subject, and it seems to me that most exchanges of goods and services are made without involving gold except as an abstract measure of value, and that some other abstraction would serve equally well except for the confusing effect it would have on people's minds. Its industrial uses are not very large, and metallurgists and chemists can probably be relied upon to provide some substitute material or alternative method of procedure that, while not quite as good, will at least serve.

While the gold that is obtained in the ways that have been described nearly always contains some silver, the amount thus recovered is almost negligible. Much silver is associated with lead and copper ores and is recovered as a by-product in the refining of those metals; the largest silver producer in the United States is the Anaconda Copper Mining Company. The ratio of the value of the silver to that of the copper or lead is usually so small that the rate of output is not then governed by the price of silver. Silver ores that do not contain lead or copper are sometimes sent to lead or copper smelters as the most economical way of handling them, and there is a diversity of other methods of recovering silver that would only be confusing to describe. The point is that only part of the world's annual silver output is directly influenced by the price of the metal, though of course the by-product producers are glad to have the price high.

While the quantity theory of money held sway, it was essential to have a large

annual output of silver to facilitate exchange, especially in India and China (and a few other countries) where silver bullion was, roughly speaking, bartered for other commodities because it was what the producers of raw materials would take most freely in exchange for their products, and it was also fairly easy and safe to transport. But with the gradual drift toward a single gold standard there ceased to be any real reason for a half-dollar being made from silver, since its value was fixed by its being possible to exchange two of them for a gold dollar. On that basis a half-dollar might just as well be minted from stainless steel as from silver. The mints began to figure on the cost of the metal and the cost of coining it into dimes, quarters, francs, milreis, etc. and the substitution of copper, nickel, and other alloys for silver in coins began to increase so rapidly that the silver producers were aghast, for its price began to decline.

THE USES OF SILVER

Industrial uses have never corresponded to more than a minor, though large, fraction of the amount of new silver sold yearly. Most silver is never really "consumed"; to a larger extent than gold it gets tied up in articles, such as silver-ware, from which it can be retrieved, when and if people want to, but a large fraction of the silver used even in photography comes back into use through secondary recovery. On the whole, the world keeps building up a stock of silver, and there is always the possibility that some corrosion-resistant alloy that is nearly as white as silver will catch the public fancy or be "put over" by an advertising campaign. The trend toward substitution of alloys for silver in subsidiary coins brought its price down to a quarter of what it had been but a few years before, and to the lowest level it had been in history.

The development of a trend toward substitution of white alloys for silver in industry would have taken the price of silver to even lower levels. The obvious way to prevent this was to peg the price of silver through its

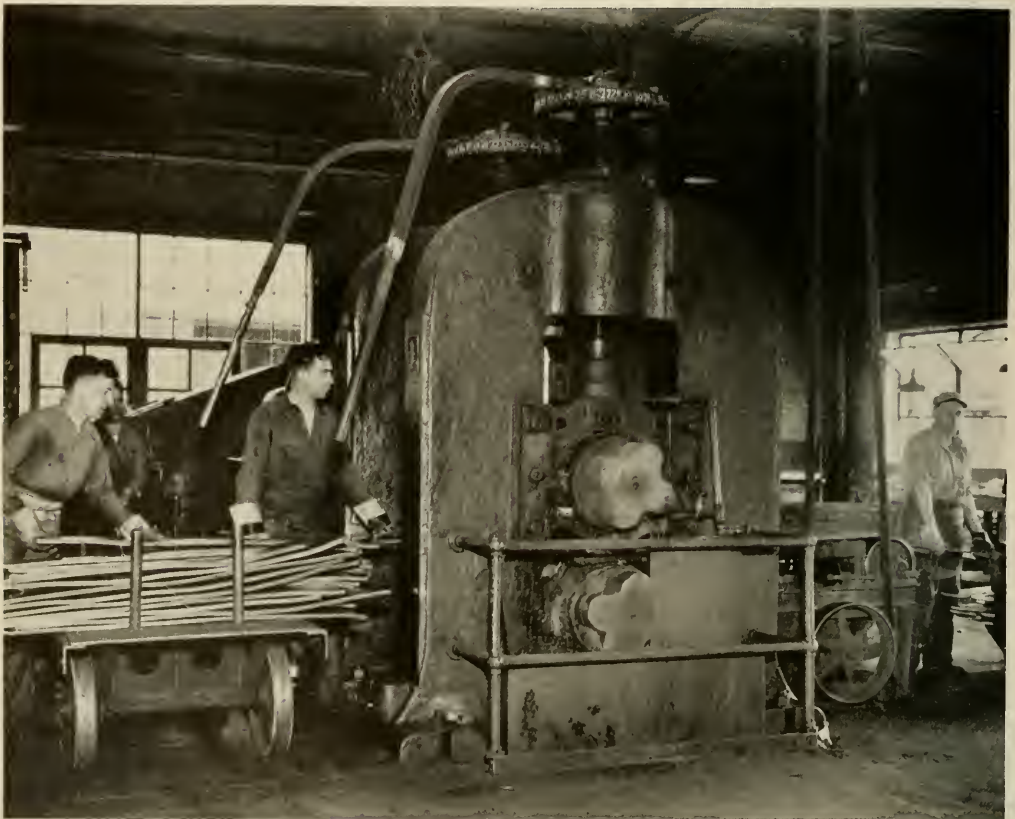


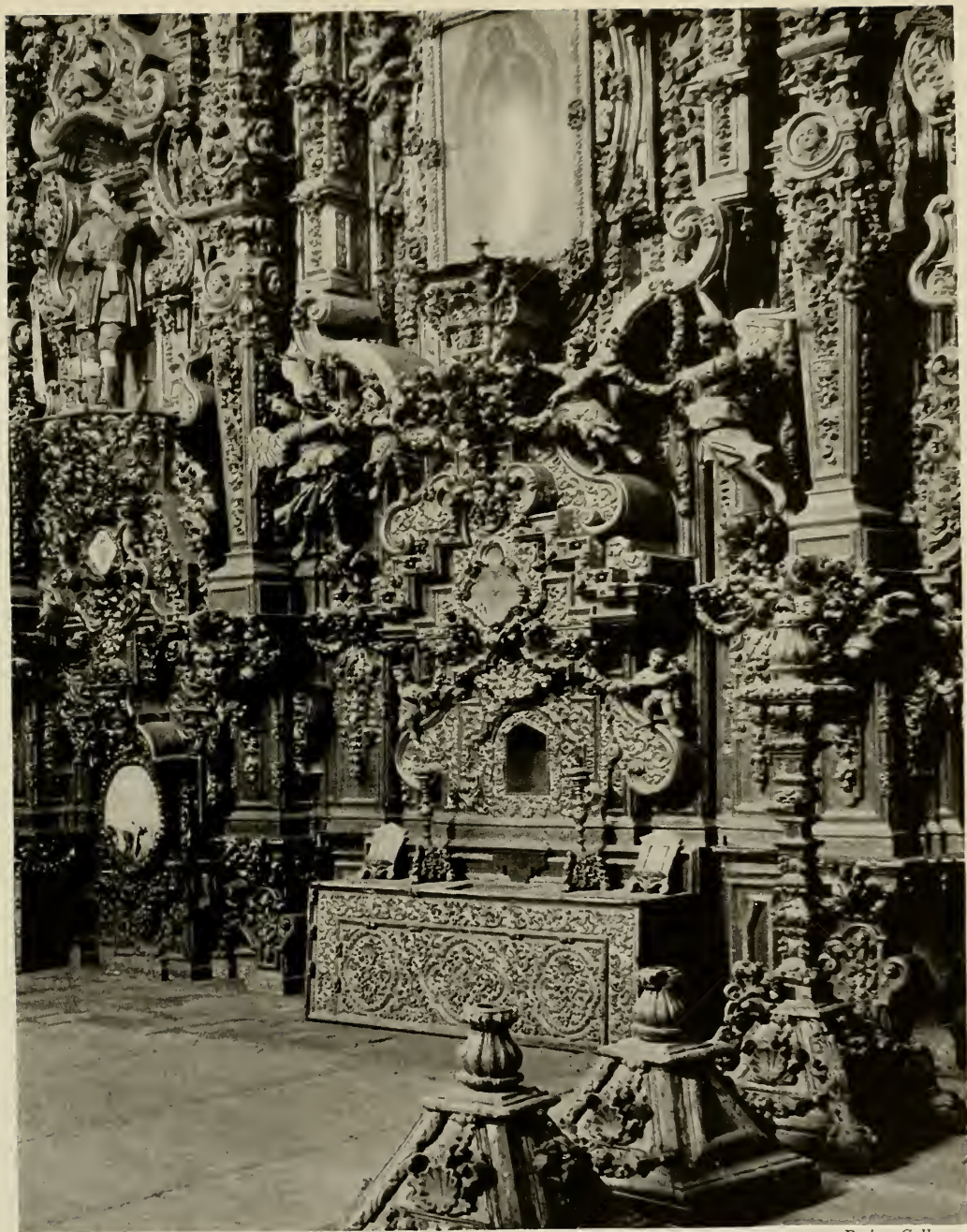
Ewing Galloway

Silver bars in a vault of the Eastman Kodak Company. Large quantities of silver are constantly being used in the manufacture of photographic plates and films

Below: Silver is widely used for the manufacture of table ware, and the factories devoted to this work use large quantities of the "white" metal. The picture below shows one step in the manufacture of spoons

Ewing Galloway





Ewing Galloway

The heavily gilded altar of the Seminario de San Martin, Mexico. Such uses for gold are now far less common than formerly, yet many displays of this kind are still to be found. Nevertheless, the gold that they contain forms a comparatively small part of the world's supply of precious metal

A Sixteenth Century Altar

monetary use, and that has now been done in the United States. There is nothing "revolutionary" about what has been done here; it will not "inflate the currency," no one cares whether a Federal bank note says "one dollar" or "one silver dollar" and few have any clear ideas as to what difference it makes. The amount of paper dollars now in circulation is only a fraction of what might be issued against the Treasury's gold stock, and though the silver certificates can be issued in payment for the silver bullion taken in, it would seem likely to me that they will either soon come back into the Treasury or else drive in a corresponding quantity of gold certificates.

RESULTS

Thus everything will be as it was before, except that the Treasury will have to provide storage space for the silver bullion (and hence may have to do some building), those people who for some time past have been speculating that the price of silver would be artificially raised will be able to collect their profits, and the producers of silver, whose previously pegged price of 64½ cents per ounce for new domestic silver looked rather precarious in the face of the world price, now

have a sort of a "back stop" in the pegged price for old bullion. The increased price will cause some increase in production in some places, but I do not anticipate that it will amount to much, and the yearly output will continue, as before, to be chiefly influenced by the rate of production of copper, lead, and other associated metals.

THE PROBABLE FUTURE

So it appears, to one chiefly interested in the technology of gold and silver production, that the "revolutionary" changes that have taken place in the past couple of years in the monetary aspects of the two metals have not produced, nor should have been expected to produce, any equally revolutionary changes in their technology. The curves of gold and silver production for the century 1900-2000 will show some change, but not much, as a result of what has been done. Various unpredictable things that might happen could change them more. For example, another Rand might be discovered in the eastern region of Ecuador, which is almost completely unexplored and uninhabited. Personally, however, I do not think it likely enough to be worth going to look for it.



"Wolf" of Mongolia

by
Roy Chapman Andrews

Leader,
Central Asiatic Expeditions

"Peiping, China (U. P.)—After 13 years of adventuring in North China, Mongolia, and on the tablelands of Central Asia, Wolf, one of the world's most famous dogs, is dead. The constant companion of Dr. Roy Chapman Andrews on all the travels of the Central Asiatic Expeditions of the American Museum of Natural History, Wolf achieved a fame which extended far beyond the borders of China. . . ."

From the *Washington Post*

I NEVER before wrote an article about an animal, but Wolf wasn't just a dog—he was an institution, in Peiping (Peking). He has been "mentioned in despatches" a score of times. Whenever the Central Asiatic Expedition returned after an exploration in the Gobi Desert, the newspaper correspondents asked first about Wolf's exploits.

Thirteen years ago he, with five other pups, was born in Kalgan, that little frontier city on the edge of Mongolia. Jack Strange loved him, but he never could keep him at home. Always Wolf was ranging the hills. Sometimes he would disappear for a week. He looked so much like a wolf that Strange feared he would be shot by wandering Chinese soldiers. Thus he came to me. Norman Lovel, one of the expedition's motor transport officers, brought him to Peiping on a cold winter's night. There were four of us in the office when he arrived. Wolf went from man to man, sniffing each one and regarding him gravely. Perhaps it was because I gave him the back of my hand to smell while the others presented their palms. Anyway, he flopped down on the floor with his head against my feet. When we left the room an hour later, I was the one he followed.

He loved camp life in the desert. As soon as preparations began in the spring, Wolf was bursting with excitement. He knew perfectly well what it was all about. One April we sent seven of the motor cars across the city in the evening to be loaded on to the train early in the morning. Only one truck remained in the compound. I was ready to go at daylight, but no Wolf. We

searched every corner of the gardens and every room in the house. Not a trace. I couldn't wait any longer and left orders to have a coolie bring him to Kalgan by the next train. A huge tarpaulin covered the truck, tied down by ropes except in front. I was driving and was half way to the city gate when a cold nose touched me on the back of the neck. Wolf's head was cautiously extended from under the tarpaulin. His look was half pleading, half reproach. I stopped the car and put my arms around his neck; with a yelp of delight he struggled out on to the seat at my side. Poor old dog! When he had seen the seven other cars driven off the previous night, he thought we were going to leave him behind. I never could figure out how he had managed to burrow under the tarpaulin, for the ropes were pulled tight and he was a large animal.

Wolf had come to believe that all dogs were his enemies. It was natural enough, because he was a foreigner in Mongolia, and the huge Mongol dogs went for him like a shot. They seemed to object to the fact that he was different. He certainly was a lot more handsome, and perhaps they resented his personal beauty. Anyway, there was no sniffing around—they fought at sight. Wolf had learned that attack is the best defense, and he generally beat them to it. What fights those were! Wolf had one advantage. He wore a spiked collar, and that protected his throat. Also he was cleverer than the others. But they have thick, matted hair, and sometimes it was difficult for him to get a throat-hold.

Wolf had discretion as well as valor. He was perfectly willing to take on any two dogs



In Larsen's compound, Kalgan. Preparations for the start for the plateau, which looms up in the background. Wolf is the most excited member of the party

The motor fleet of 1928. Wolf suffered from car sickness the first day out in the spring, but after that he seemed to enjoy the changing scenes and the excitement of the long days of travel across the desert





Wolf and His Master

Wolf was on friendly terms with all members of the camp, including the Chinese and Mongol servants, and especially the cook, but his master always came first in his affections

in Mongolia, even though they were bigger and heavier than he, but he watched his step when there were three or more. The Mongol dogs are terrifying beasts,—larger than a police dog, black with brown points, and savage as tigers. From earliest birth they are taught to guard the caravan or camp, and will attack a stranger at sight. Not only that, they will eat him, too. The Mongols have a peculiar custom. They do not bury their dead. Instead, they throw out the corpses to be devoured by the dogs, wolves, and birds. Near a lama monastery packs of dogs that live largely upon human flesh are always prowling about. In Urga, the capital of Mongolia, it is most unsafe to go out at night unarmed. I came into Urga one evening on horseback after a seventy-mile ride. My pony was dead tired and trotted slowly up the main street. Suddenly five large dogs rushed from behind the old Russian Consulate. One leaped for my leg, but I kicked him off and he caught the stirrup leather; another fastened his teeth in the pony's hind leg, and a third got a hold on his tail. As I pulled my rifle from the holster, the pony lashed out wildly with both feet. One dog rolled over yelping, and instantly the whole pack were upon him. In less than five minutes the injured dog had been devoured. I watched a pack of dogs tear apart a dead Mongol who had been dragged out from the Lama City. It took just seven minutes to scatter the corpse over the plain. I won't give you the details for it wasn't a nice sight.

MAN-EATING DOGS

I had a narrow escape myself from being eaten by fourteen dogs while lying asleep in a fur bag on the desert near the Turin monastery. Only a lucky shot from a tiny 22-caliber rifle which killed the leading dog and turned the pack saved me from a horrible death. Almost every member of the Central Asiatic Expedition has been attacked, and we made it a rule never to move from camp without a revolver.

Thus you can see what pleasant compan-

ions Wolf had in Mongolia and why he didn't like them. He was a dog of breeding and character, and it was a long way beneath his dignity to associate with canines that eat human flesh and are cannibals besides. He knew that he never would get a square deal; that they would turn on him at the first yelp; so he declared war on all dogs.

WOLF AND THE WOLVES

Wolves he didn't like, but I think he respected them. He knew they were bad medicine even for a fighting police dog. The Mongolian plains wolves are long-legged, rangy beasts perhaps a little heavier than Wolf was. He would bark at them from a safe distance or if one of us backed him up with a rifle, but he would not attack in earnest. Two wolves came near camp early one morning. Wolf routed me out of the tent by frantic barking. When he saw that I had my rifle and was following, he dashed furiously at the wolves as though he would finish them both off. They loped slowly away at first but suddenly stopped and faced him. You should have seen him put on brakes with all four feet! He wasn't having any, thank you. As he saw me drop on one knee to shoot, he jumped to one side and waited for what he knew would come. I killed the nearest one but the other was only wounded. He whirled about and tried to run, but Wolf was on him like a tiger. When I came up, Wolf had his deadly throat-hold and the story was almost ended. Again, early one morning, a wolf walked right into camp; I suppose it was curiosity. We tried to "sic" Wolf on the animal but he wouldn't be "siced." He gazed about the landscape in the most interested manner in every direction except at the wolf. He knew that we were not backing him up with a rifle and he didn't intend to be the goat for anybody's fun.

Gazelle drove him wild for he couldn't catch them. One morning a great herd came up out of the badlands not a hundred yards from the tents. They streamed over the rim of the basin in a yellow flood, thou-

sands of them. Wolf would dive for an antelope like a bullet. It would wait until he was almost ready to spring and then leap away. Since a gazelle can reach a speed of sixty miles an hour for the first dash, poor Wolf didn't have a ghost of a chance. The animals were only playing with him and he knew it. After an hour he dragged himself into my tent absolutely exhausted and flopped down. He simply radiated disgust, and it was perfectly evident what he thought about all antelope.

"HIS" GAZELLE

But he got his own back one day. A herd of gazelle came within a few hundred yards of camp. Jumping into a car with Mac Young driving, we had a shot in less than five minutes. I wounded two bucks, but they could still run at a very respectable speed. Wolf had followed the car and had almost caught up with us when I fired. Without a pause he shot by, racing for the nearest gazelle. Mac and I jumped into the car to watch the finish. It was a beautiful race. Inch by inch Wolf hauled up on the buck. For a hundred yards he ran almost at its heels; then with a terrific spring he hurled himself on to the quarters of the gazelle. They rolled over together, but Wolf had a hold on the flank, and his weight held the antelope down. Suddenly shifting to the throat, he tore open the jugular vein. When we had the antelope in camp, Wolf lay down beside it and for hours would let none of us come near. It was his buck, killed by himself, alone, he thought. It represented final victory over the animals which had so often made a monkey of him before all the camp.

In spite of this, Wolf assumed responsibility for the safety of a baby gazelle which we had as a pet. One of the Mongols caught the little thing when it was only a few hours old and brought it to camp in the sleeve of his coat. Wolf knew instantly that that gazelle was not to be killed. It was so tiny and helpless that it had to be protected, and if our two ravens attempted to annoy it as

they did everything else, Wolf would drive them off like a tiger.

Wolf met his match one day in the shape of a hedgehog. As you know, these little fellows are about half the size of a hare and are covered with spines as sharp as needles. When they roll themselves into a tight ball, they are absolutely impervious to attack. Wolf's first hedgehog drove him nearly mad. He couldn't figure it out at all. It smelled like an animal but it didn't feel like any animal that he had ever touched. Biting only got his mouth full of quills. Rolling it over with his paws pricked his feet. Barking didn't do any good. When it uncurled and started to run, at his first touch it rolled up again. For two days he puzzled over the enigma assisted by a Mongol puppy and a pet crow. At last he definitely gave up. But he had lost so much "face," as the Chinese say, over the performance, that he decided completely to ignore the existence of the darned thing. We kept it as a pet for months, but never would Wolf so much as glance in its direction, even though it actually ran over his feet. He would move quickly away, apparently absorbed in some object on the far distant horizon.

"CONNIE" THE VULTURE

Another of the camp pets used to annoy Wolf a good deal. This was a black vulture. It is one of the largest birds of the world and has a wing spread of ten feet. Ours was named "Connie." She had been reared from a fledgling and, of course, was perfectly tame. Wolf had a particular place in the back of the tent, close against the cloth, where he loved to sleep. Connie liked the same spot. When she found Wolf in possession, Connie would go to the outside and jump up and down on the cloth directly over the dog. Wolf would wake with a start and dash out only to find Connie hurrying to get inside before he returned. This is really true. I have the evidence of all the other men on the expedition to prove it. You have to be particularly careful about your stories when

Friends and



Left: Wolf could kill a sheep with ease, but the hedgehog completely baffled him and he finally accepted it as a member of the party

Below: Connie, the black vulture, shared honors with Wolf as the Number One Camp pet in 1925. She came to the expedition as a fledgling and is now in the Bronx Zoological Garden



Acquaintances

Right: Wolf and Dr. Walter Granger survey the field from a newly established camp on the desert



Below: A baby gazelle and its foster mother. Wolf understood clearly that the gazelle, the goat, and her own kid belonged to our camp and that they must not be harmed



there are fifteen other men who can check you up.

Wolf didn't like Connie but he tolerated her. Except when she drove him out from his place in my tent, he assumed a lordly indifference and disdained even to notice her. A Mongol puppy which we had, loved to play with the vulture, but not Wolf. He was the most dignified and the most jealous police dog I have ever known. For instance, he simply would not tolerate another dog in the Peiping house.

WOLF, THE SHEEP KILLER

Wolf had one bad habit that nearly cost him his life. He was a sheep killer. It is almost an axiom that sheep killing can't be cured in a dog. I don't think it can, permanently, but I did cure Wolf temporarily. The method, however, was pretty severe.

The disease developed in Wolf rather gradually. The first year he was with us nothing happened until the middle of the summer. Then Walter Granger came into camp one night and reported that he had found two freshly killed sheep in a ravine and had seen Wolf not far away. Apparently the two sheep had strayed from the flock, Wolf had come upon them suddenly, and was overcome by temptation. This first experience of such a diverting pastime gave him the germs of a disease which raged in his blood like a fever.

A few days later George Olsen actually saw him kill a sheep. The Mongol owner came into camp highly incensed but was pacified by receiving more money than the animal was worth. We ate the sheep. It became a common occurrence, and the men complained of having too much mutton. But I will say that Wolf was a good judge of sheep so far as their edible qualities were concerned. He always picked tender ones. Finally we had to tie him up until we left that place.

At the next camp our caravan joined us. The loads were no sooner off and the camels peacefully grazing out on the plain than Wolf began to do his stuff. Selecting a

camel right in the middle of the herd, he drove it out, biting and barking at its heels. When he had frightened the poor beast half to death and it was running across the desert as though the devil were after it, Wolf came back for another. In half an hour, in spite of all the Mongols could do, our camel herd was fleeing in every direction; we couldn't stop Wolf. He was deaf to all commands and no one could catch him. He was possessed of but one idea—to scatter that herd. Some of the camels were so frightened and ran so far that our Mongols did not find them for three days.

Of course Wolf was tied up after that performance. But he seemed so penitent and pitiful that I let him free after a week's punishment.

Our next camp was on the edge of an oasis near a Mongol village. The first evening Wolf distinguished himself by tearing the throat of a heifer and scattering the herd of cattle to the four winds of heaven. I gave him a severe beating, which certainly hurt me more than it did him, and tied him up for another week.

THE LAST STRAW

The climax came some time later when he killed two sheep half a mile from the tents. A big Mongol rode into camp absolutely furious. Before he calmed down I thought blood would be spilled, the worst of it being that he was perfectly right. We didn't have the ghost of a defense. He said that if we did not keep that infernal foreign dog tied up, we'd have to leave right then or he and his friends would drive us out. It was a rich fossil field and we couldn't go. We tried another method that I hoped would work because of Wolf's great dignity. With a short rope I tied one of the dead sheep to his collar. Wherever Wolf went he had to drag that sheep. It was to be a constant reminder of his sins. Never did I see a more dejected or humiliated dog. He wouldn't look at anyone; he was crushed to earth. After two days of living beside the dead sheep his condition was pitiful. But I

thought for good measure that he had better have another twenty-four hours. Then we let him loose and I watched him carefully.

There were half a dozen sheep near camp. For five minutes Wolf ran from one tent to another visiting every member of the expedition just as though he had returned from a trip abroad and was infinitely glad to be home. He seemed to want to dispel the idea that he had ever been so disgraced as to be tied for three days to a dead sheep. I had decided that either Wolf had to be cured or he must be killed. We couldn't stay in Mongolia and have the natives turned against us by a sheep-killing dog. Much as I loved Wolf, the expedition was more important than his life. As a last resort I determined to give him a dose of fine shot. For an hour after his release Wolf was able to resist the temptation of those grazing sheep. Then, suddenly, he cracked. I saw him gaze fixedly at the animals and begin to tremble. Saliva dripped out of his mouth and like a shot he was off. Shouts were useless. He was in the grip of an uncontrollable disease.

CURED—TEMPORARILY

I grabbed my shotgun and, just as he sank his teeth into the throat of a young ewe, I fired a charge of No. 6 shot at his hind quarters. The impact knocked him off his feet, but he certainly was a sportsman. He never even yelped but limped off silently behind the camp. He circled about and tried to crawl into my tent. I hardened my heart and drove him away. He went to George Olsen's only to be refused asylum. Out on the desert he crawled and lay down a hundred yards from camp. I was almost weeping but he had to be cured or killed. After an hour I asked Doctor Loucks, the surgeon, to go out and examine him. He reported that Wolf's rear end was pretty well filled with shot but that no bones were broken and that he would be all right in a few days.

Next morning he was a sorry spectacle, so stiff and sore that he could barely walk. He got no sympathy or petting, but by the

end of the week he was pretty well recovered. Did it cure him? Yes, temporarily. We had no more trouble that season. Whenever sheep were near camp, Wolf would deliberately lie down in the rear of my tent, away from temptation. If I saw the suspicious trembling and drooling, a sharp word sent him into the tent.

THE DISEASE RETURNS

But the next season the old disease was back upon him although not so strongly. He could resist it if one of us were near, but he did kill two or three sheep before the summer ended. The treatment had one bad permanent effect, however—it made him deathly afraid of guns. Even in Peiping when I was practicing with my revolver in the mornings, Wolf would crawl under my bed until the shooting ended. He feared a gun so badly that it was next to impossible to get photographs of him. The moment a camera or a stick was pointed in his direction he ran like a stag. The poor dog had another experience which he never forgot. The surgeon, Doctor Loucks, wanted to inoculate him against rabies before we went to Mongolia. He had to be muzzled and trussed like a pig for market, and I never have seen such abject terror exhibited by any animal, although he was not hurt in the slightest. In some way he associated it with the shooting in Mongolia. Like many surgeons, Doctor Loucks had a faint odor of iodoform about his clothes. From that moment on the smell of iodoform or the sight of an instrument case would send Wolf into the gardens, up the stone rock work and on to the roofs. He used to prowl for half a mile over the roofs of the neighboring houses, hunting cats and greeting the dogs in the various compounds; but he never descended except in our own yard.

He was ill one day and I telephoned Doctor Loucks to look him over. Wolf was lying on the floor in my office. The instant he heard me mention his name, he sat up listening intently. He would not go back to sleep, and half an hour later when the doctor

Wolf was the least concerned member of the party when sand, rocks, or mud made trouble



Above: Back in China. A halt to replace a broken axle on the return journey from Kalgan to Peiping. Familiar sights, sounds, and smells tell Wolf he is nearing home



Right: Wolf's car. He was usually tied short so that should he be jolted off he would not fall under the wheels

At Baron Sog



A Mongolian Lamasary

Wolf from a safe vantage point can survey the numerous lamasary dogs and enjoy the muttomy odors of the lamas themselves. Wolf was always ready to take on one or two lamasary dogs for a fight, but usually there were too many for him, and he was safer on his car



Wolf's great temptation. Unlike the Mongol dogs Wolf could not appreciate the sacredness of the Mongol's sheep and goats, and he became a "killer"



In U. ga. Half wild Mongolian dogs being fed by lamas in the streets of the Capital. It is these same dogs which devour the human bodies thrown out on the City's mortuary dump

arrived, he took one look and dashed for his safe haven on the roofs. The Chinese servants all firmly believed that he could understand English, and they used to warn me not to talk about him over the telephone if he were present.

WOLF AS A HOST

When a visitor came to the house, Wolf greeted him with delighted barks. He would sit up and offer his paw and everyone instantly succumbed to his charm. But Wolf knew in a few minutes whether or not they were just being polite or whether they really liked dogs.

I remember that Noel Coward, the actor-playwright, captured his affections at once because Noel adores dogs. Before I knew it, they were rolling over and over on the floor, having the most wonderful romp. While Noel was in the house Wolf would not let him out of his sight.

When the expedition was in the Gobi, Wolf was a busy dog. Everything that went on about the camp was his concern. At night particularly, did he feel his responsibility. As long as candles were burning in the tents, he would drop in every half hour for inspection. When the men crawled into their sleeping bags and extinguished the lights, Wolf would make a last visit, nuzzle each one to be sure that he was all right, and then cross that tent off his list. After all the lights were out Wolf would lie down about ten feet in front of my tent and doze for a few moments, but always with one eye open. Once or twice during the night he would inspect the camels, although he seemed to feel that they were not really a part of his job.

It was a sad time for both Wolf and me in 1932 when I closed the Central Asiatic Expedition's headquarters in Peiping. It meant breaking up the home in which we had lived for twelve years. And it meant

saying good-bye to each other perhaps forever. With the initial packing, Wolf's excitement rose to fever heat. He thought we were getting ready for Mongolia. Then slowly he realized that something was wrong. This wasn't the usual kind of an expedition. There were no motors chugging in the great front courtyard and the rooms were being dismantled. Sadness crept over him and he drooped like a half-dead flower. The last week when an auction sale was held in the house Wolf was really ill. For two days he touched no food. He drank water in great gulps but I could not tempt him to eat a mouthful. He lay on the floor in my bedroom, gazing sorrowfully at me with his big brown eyes. If I moved, he was at my heels. He did not want to leave me for a second in what he knew perfectly well were our last hours together. The day before I left Peiping, I took him in my car to the house of one of my friends, Mr. H. R. Elkins, manager of the Peiping branch of the United Press. Wolf ran about inspecting the rooms but always coming back to gaze into my face. In the hall, when I put my arms about his neck to say good-bye, his head was wet with the tears which I could not control. I never saw him again.

LEFT BEHIND

You may wonder why I did not bring him to New York. It would have been cruel to him. All his life he had roamed the plains of Mongolia or had a great Chinese compound in which to run. For him, in New York, life would have meant my pent-house roof; lonely days when I left in the morning and only a few brief hours together while I was dressing for dinner. It would have broken his heart—he would have died in six months. Far better that he stayed in China in the surroundings where he was born, with a new master who soon became his devoted slave.

The Gobi Bird Group

by

Roy Chapman Andrews

Leader, Central Asiatic Expeditions

A new exhibit recently opened at the American Museum, portraying the birds of the great Mongolian desert

A NEW bird group has just been opened in the American Museum in the Hall of Birds of the World. This shows the bird life in the Gobi Desert, and depicts what the members of the Central Asiatic Expedition to Mongolia saw from the door of the mess tent. In the distance is the eastern range of the Altai Mountains with the snow-covered peak Baga Bogdo (Lesser Buddha), dominating the surrounding country.

So far as we know, this peak had never been climbed by a white man before its summit was reached in 1925 by Lieut. Frederick B. Butler and Dr. Harold A. Loucks. The Mongols told us that it was a sacred mountain and that anyone who attempted to climb it would begin to bleed at the mouth and shortly afterward die.

On the southern side of the peak are beautiful meadows inhabited by numbers of the great Altai sheep (*Ovis ammon*) and ibex. At the base of the mountains is a long line of sand dunes extending for fifty or sixty miles east and west.

Tsagan Nor, the lake in the background, is a typical example of the saline lakes found in various parts of the Gobi. Although this was fed by a fresh-water stream and a few springs, nevertheless the water was too salty to be fit for human consumption. The camels, however, drank it with pleasure.

In 1922, when the expedition first visited the lake, it was very much larger than at the time represented by this group, which was in the season of 1925. At the end of that year, after Major L. B. Roberts had made a careful map of the lake itself, the water completely disappeared, leaving only a white expanse of salty mud.

The lake was a breeding ground for many kinds of water birds. The most beautiful were the ruddy sheldrake, two of which are

shown in the background. The graceful demoiselle cranes in the foreground arrive in Mongolia in the spring in great flocks, and it was a never ending source of interest to the members of the expedition to watch the birds in their mating antics.

The Mongolian skylark, another typical Gobi Desert bird, is in great demand by bird fanciers in China. Thousands of the young are captured and sent to Peiping and other large cities, where they are sold at from one to five dollars. The skylark has a most amusing habit of mewing exactly like a cat.

The sand grouse shown on the right side of the group are Gobi birds which are of importance to every traveler. Near every bit of water they swarm in millions in the morning; they furnished for us a most welcome food supply as well as excellent sport.

The Gobi Desert is alive with raptorial birds. Hawks, eagles, kites, and great black vultures are to be seen at almost any moment sailing in the sky or swooping down on to the desert.

The season of the year shown in this group is early summer after the birds have mated, and the time is late afternoon, when the lengthening shadows have brought out the beautiful contours of the sand dunes and the desert. Mr. F. L. Jaques, the artist, has caught in an extraordinary manner in his painting, the brilliant light of the dry, clear atmosphere in the Gobi. When I first saw the group, I congratulated Mr. Jaques on the clever lighting by which he had been able to produce the effective shadows of the birds and plants. To my intense surprise he told me that all the shadows were painted.

The foreground of the group is typical Gobi vegetation and terrain, the gravel having been brought from the desert by the Central Asiatic Expedition.

In the Gobi



Birds of the Desert

This lifelike presentation of the birds of the Gobi Desert has recently been put on display at the American Museum, in the Hall of Birds of the World. The scientific information and the specimens were collected by the Central Asiatic Expeditions, and the view portrayed is the one seen by the explorers from the door of their mess tent. Demoiselle cranes, ruddy sheldrakes, Mongolian skylarks, sand grouse, hawks, eagles, vultures, and other birds are included in the group, with a salt lake called Tsagan Nor in the background, beyond which appears a part of the eastern range of the Altai Mountains

The Toradjas of Celebes

by
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Trustee,
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Even in the modern world there are peoples so detached from the affairs of civilization as to feel few of its influences. The people of the Celebes hills make up such a group

C ELEGES is one of the four great Sunda Islands of the Dutch East India Archipelago. Inhabited by three important Malay people, the Bugis, Mandars, and Toradjas, it is the last one of these that this article will attempt to describe.

A great part of the area of this island has been barely, if at all, touched by civilization. Since the Dutch occupation, head-hunting and war, which used to be major occupations of the inhabitants, have been stopped, yet the natives still observe their primitive tribal customs and mode of life. Civilization, to them, has been merely the introduction of law and order (drink, disease, and degeneracy never having touched them). Like their neighbors in the adjacent groups of islands, they always have been fiercely warlike, a tendency which was not restricted merely toward the natives of other islands, for they formerly fought frequently among themselves. As true head-hunters, they looked upon heads as their greatest trophies, and zealously guarded them when they hung along the interior walls of their houses. This practice, however, offended the Dutch, who have had them all removed.

The Toradjas, being people of the hills, have most of the attractive characteristics that are common among such peoples. Beautifully built and of medium height, they are virile to an unusual degree. Though their faces are regular and very fine, the features are, unfortunately, often marred and distorted by massed stains and hideous wads of betel nut which they carry in their

mouths or under their lips. So large are these wads that their faces are often twisted quite out of shape by them. Their sense of humor is excellent and, though often bitterly cruel and with fiery courage, they nevertheless are most kindly toward strangers to whom they have taken a fancy. Their hospitality is extreme. Immediately a visitor enters a village, for instance, if he has been properly introduced by a person friendly to them so there will be no shyness on their part, he is certain to be served with fresh roasted corn and a mild sugar-palm wine.

The topography of the Toradja country is one of low chains of hills and mountains with frequent broad valleys between. These valleys are usually upland ones running as high as 2000 feet or more above sea level. The villages are located on the hills, which are steep with narrow ridges. Except where the land has been cleared for agriculture, it is covered with a dense rain forest that usually extends to the borders of their villages, while, from November to May, the rains of the northeast monsoon come down with true tropical intensity. This country, which is considerably higher than the sea coast of the island and is intersected by mountain ranges running as high as 5000 feet, is directly in the path of the warm, moist winds coming from the surrounding seas. Consequently this area receives a great deal of precipitation and takes the brunt of the rains of the island. Even during the so-called dry months of the year, afternoon showers are frequent.

The virgin jungle is dense and heavy with underbrush of massed spider-web growth



Toradja Houses

Each of these houses is occupied by a communal family group, in which the lives of the old and the decrepit are likely to be far from easy. The houses are built of bamboo and palm, and are usually decorated with excellent polychrome carvings in which the art of these people is carried to its highest point



Toradja

Left: Members of a hunting party. All Toradja men carry the sword-like knife

Below: A market day group. The bartering of pots and bowls, agricultural products, and other wares is the only method of carrying on trade





Villagers

Below: A Toradja man with a typical native basket. The art of these people shows to better advantage in their wood carving than in their pottery and basketry

Right: A Toradja woman with a native stringed instrument that is cleverly and artistically carved



The large photograph was taken on one of the weekly market days, when villagers from round about congregate at a conveniently located spot easy of access from each of the neighboring villages. Various products, both of agriculture and of the local arts, are displayed, and brisk trading, by barter, is the order of the day

and thorn. To travel through it is heavy work and can be accomplished only by methodically chopping one's way.

As the villages of hill tribes go, those of the Toradjas are small. The houses have two floors, set close together and built on piles, though from the point of view of either rain or flood there seems little reason for this as, due to their elevated location, there is ample drainage. These houses, which are highly interesting in themselves, are most carefully built, often at great expense to the owners. Made of bamboo and palm, with their thatched roofs beautifully curved upward at both ends and extending from six to eight feet over the end walls, they protect the exquisite polychrome carving that is lavished on them. Even the small rice houses standing near by are perfect miniatures in detail of the owners' dwellings. Some of the latter, more particularly those of the rich, take as long as one and one half years to build.

As good water is everywhere, the Toradjas have greatly simplified their system of supply. By splitting bamboos into halves and removing the intersecting joints, they have formed admirable small troughs. Many of these, when joined together, form conduits which bring the water from the near-by streams or springs not only to the village but actually to the individual houses.

There are no fireplaces that can be used for heating purposes. What fire they do use is solely for cooking purposes and very curious and original are the receptacles in which this is done. Small troughs of wood, hollowed and lined with native tin, form permanent and safe places for the fires, which burn nowhere else.

COMMUNAL LIFE

The Toradjas live in communal family groups, each group occupying one house. As the married sons bring their wives to live in the house, too, it is common to see several generations all together. In such a community, the lot of the old and decrepit is not an easy one. There is no seeming reverence

for age and, since everyone has to work, the elder members of the household and, more particularly the women, do all the more menial jobs. They are an agricultural people with rice as their main staple. Due to the steepness of the hills on which they live, the terracing of the latter is difficult, and they prefer to plant their crops in the near-by valleys. Small rest houses with thatch roofs are set in the cultivated areas, and in these the workers find protection both from the sun during the hot hours of the day and from rain. The villages themselves are not always visible from the valleys and, on first sight, one often wonders where the inhabitants can possibly live that have cultivated such vast areas.

CROPS AND SCARECROWS

Their crops, are, of course, exceedingly important, and naturally attract the many birds of the region. Consequently, many ingenious devices have been developed to frighten these marauders away. An amusing one is a piece of bamboo about six inches in diameter, halved and strung across a small, rushing stream that adjoins the fields. The hollow part of the bamboo faces upstream and, getting the full force of the current, it continually jerks the hempen cord to which it is attached. This cord, which is extended out over the fields, has everywhere fastened to it a series of tiny bamboo whistles which are thereby in constant operation. The noises so caused really serve a double purpose. Not only do they frighten away birds, but many evil spirits are likewise urged to go elsewhere.

Usually once a week there are grand market days that are attended by the citizens of neighboring villages. The various products, both of agriculture and of their own arts, are displayed, and brisk trading takes place through the medium of barter. These marts are always located at a central spot in some valley.

The arts of the Toradjas are quite simple. The women weave a strong linen cloth about the size of a roller towel which is colored



A
Paddy
Field

Rice is a staple food among these people of the Celebes, and near the rice fields, which are located in the valleys while the villages are in the hills, small rest houses are erected in order to furnish shelter from rain and from the sun during the hottest hours of the day

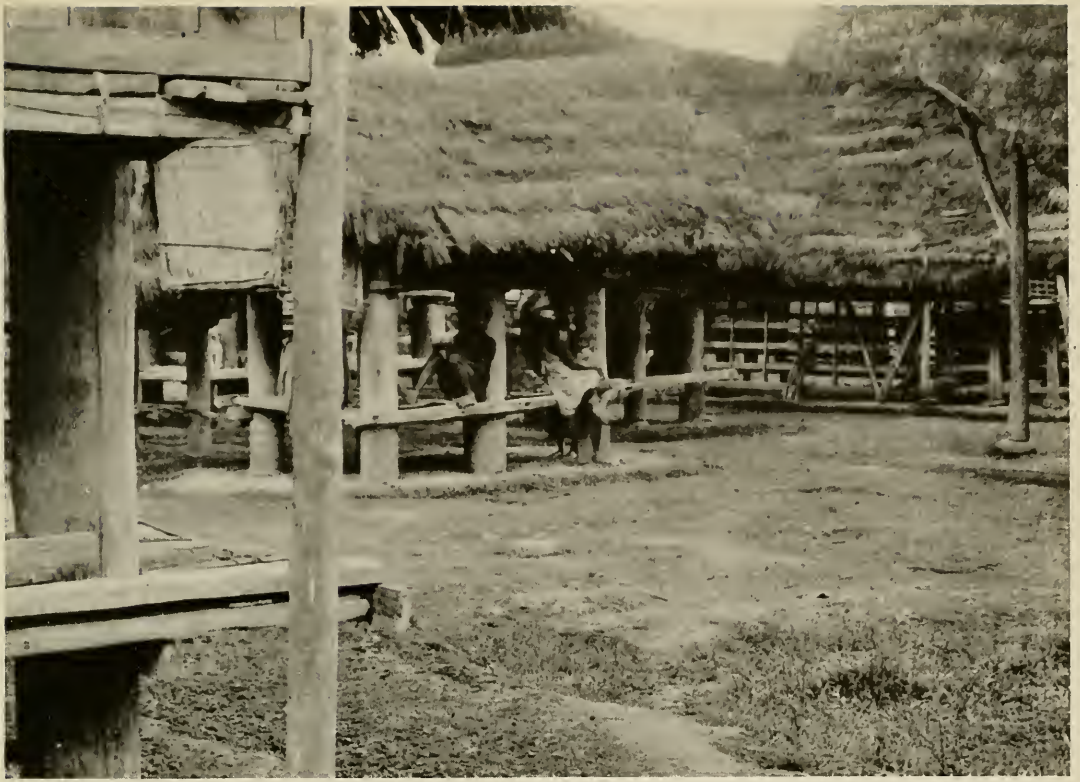


Native Architecture

The houses of the Toradjas have two floors set close together, the whole structure being supported on piles

Below: The thatched roofs curve upward at both ends, extending far beyond the walls





Above: These houses are often built at great expense to the owners, and sometimes take as long as a year and a half to complete. The carving with which they are decorated is often beautifully done



Right: Small rest houses are built in the fields, for both the sun and the rain can be oppressive

either a loud blue and purplish check or white with a red band. It is used by men, women, and children, who drape it around their heads, shoulders, or loins, the young women often using it to hide the lower part of their faces from strangers. Another type of weaving consists of coarse brown, red, and black bed covers. They are commonplace in hue and design, and show great deterioration from the charming ones created by these people fifty years or so ago. Their household utensils are composed of a few wooden or clay bowls and spoons. The former often are very nicely carved and are used in ceremonial processions, when they are filled with fruits and rice and carried on the heads of young women. The spoons are also carved, but they have no ceremonial uses, being designed simply to avoid the necessity of eating with the fingers. A few baskets are woven but are uninteresting in appearance and of mediocre quality. The men have *krises* (long swordlike knives) that are finely made of native metal with both the blade and the handle in elaborate design. Except for these and the cooking utensils, the only use they have for metal is in tipping their plows. When working in the fields, the men wear basket-like contraptions that cover the whole of their backs. These give them protection both against the sun, should it be too hot, and against rain. In order to profit by this protection during the downpours, they lean far forward and so keep dry. A proud man it is who can wear the skin of a "tokata" (dwarf water buffalo) over this basket; this would be characterized as full dress and not many own such valuable apparel.

WAR IMPLEMENTS

The Toradjas' implements of war are merely the kris and the blowpipe, the latter a formidable weapon five feet long that shoots a tiny dart at surprising velocity. This little dart is feathered at its base to give it accuracy, and for a short distance, such as twenty feet, it will fly out at such speed as to be practically invisible. It and the kris are both impregnated with a deadly poison.

As for religion, the Toradjas are nature worshipers, the most primitive of all religions. The only living objects of worship they have are blue-eyed albino water buffaloes, and, as these are extremely rare, they are very expensive and highly treasured. These animals spend their lives most carefully tended in open pens. Not every village can boast of such a possession.

BURIAL CUSTOMS

This is the country of the famous rock graves, interesting because, so far as is known, the inhabitants never have dwelt in cliffs. The graves, with which they take infinite pains, are situated where there are natural rock caves or slotted openings high up on the faces of almost perpendicular cliffs. These appear to be in wholly inaccessible places. The bodies of the dead, after having been embalmed and wrapped in bits of cloth, are laid on a rocky shelf, and then are merely covered with sticks of wood. The better types of graves have elaborate and beautifully made human effigies placed beside them. These effigies are carved out of wood and made life-size. Painted and dressed, as they always are, they give one a weird feeling when one comes upon them unexpectedly and sees ten or twelve pleasant faces leaning on a rail and peering down.

Like their Malayan brothers, every Toradja man that can, caresses and fondles a game cock. These are bred for their own private cock fights about which they show tremendous enthusiasm. As an additional spur, they fasten to each leg of their cocks a short blade of native metal about three and one half inches long and sharpened to a razor edge. For this reason the fights are of short duration and, since the blades are poisoned, any wound causes death. The Toradjas are ardent betters, which adds greatly to the excitement of these fights.

On this island the most interesting of the extremely few species of larger mammals are two indigenous types of the water buffalo.

These are called anoa (*Bos depressicornis*), the local name being tokata. Except for size, there is a good deal of resemblance between them. The lesser of the two are most interesting, being the smallest members of their species in the world. Both of these are brown in color, show no distinctive markings, and have short, very sharp horns not dissimilar to those of antelope or gazelle.

THE DWARF WATER BUFFALO

Their habitat is limited to the dense jungles, as only here does the plant life grow on which they feed. The larger ones sometimes come into the open and attack domestic water buffalo. Then they charge the latter and go straight for the stomach, frequently causing such serious laceration as to result in death. This courage and ferocity is not lacking among the smaller ones, who, when wounded by native hunters, may likewise charge ferociously.

The natives occasionally hunt the smaller tokata. As the animals must, naturally, be sought in their own habitat where, due to the jungle, progress is slow and practically without visibility, the natives have trained dogs to follow the scent. To anyone not native to these jungles, such a day's hunt is hardly a pleasant jaunt.

Having decided to try our hands at this new game, we made an early morning start, and, after walking for a bit up the bed of a small, rocky stream, we entered the jungle. Incidentally, stream beds, no matter how numerous their rocks and boulders, were followed in preference to the jungle, as the going there was actually better. On entering the jungle, we started immediately to climb a sharp ridge, and from then on most of the day was spent either in further climbing or in descending. Two men with their krises were in front laboriously opening up a meager trail. The foremost cut away the absolutely impassable barriers, while the next one cleared off the ever-present thorny growth that, semi-cut, hung about in festoons. Soon game trails were found and, later, clear signs of a tokata's hoof marks of

the previous night. The dogs, however, did not seem to want to honor the scent, nor did our native guides seem to care a bit whether they followed the game trails or not. Traveling was simply dreadful, due not only to the denseness of the underbrush and thorn, but also to the steepness of the way and the slipperiness of the drenched ground. Our guides' bare feet with ten good, clinging toes gave them a great advantage over the spikes we wore. Not even once during the several days' hunting did a pair of bare feet let a man down. This could hardly be said of the spikes.

Sometimes during the course of the day there were light showers, but one was aware of them more through sound than feel. The close proximity of the trees with their interlaced tops formed an almost complete umbrella. But the moisture, nevertheless, seeped through, and it was this that kept the ground always in a slippery, dank condition. When traveling along the edge of ridges, one forever had to be prepared to hold on, but going up hill was exhausting. If the trail were extra steep, the ground would be correspondingly looser, and hauling one's self up on hands and knees was then the common task. There was plenty to hold on to ever ready at hand, but much of it was thorny, and many of the small trunks were rotten with age and snapped with the slightest strain. To the natives, born in this country, climbing or descending was apparently as simple as traveling along the flat, but bitter were the moments to me when, having just completed some very heavy hill work, we found it had to be immediately repeated.

JUNGLE TRAVEL

The skill with which the natives moved through the jungle was remarkable. Their procedure was not so much that of a walk as a slow and careful slink. Traveling more or less naked, but miraculously avoiding thorns and particularly the vicious ones of the rattan, they would finish the day without a scratch.

We started the hunt armed with a rifle

Below: The niches in the face of the cliff are graves, and the figures shown standing at the rail are elaborate human effigies, carved from wood and carefully painted and dressed



Above: A valley in the Toradja country. The vegetation, owing to the plentiful supply of water, is beautifully green, and clear, rushing streams are numerous

The structure shown below is the grave of a local sultan. It takes the form of a typical Toradja house, with thatched roof, carved woodwork, and upturned, overhanging ends



A load of clay bowls, made fast to a bamboo carrying pole. These are commonly used by every household, but are seldom decorated. The native artistic instinct seems at its best only in wood carving



A family group, resting on the lower floor of a handsomely carved and painted house. The carving shown at the top of this picture is in a typical Toradja design, which is the more attractive for the coloring that has been added

and a camera, but after the first three minutes they were turned over to a native to be carried. The denseness of the jungle made the former useless, and after the second day it was left behind and the owner became just a spectator. Due to lack of visibility, the camera might as well have followed the rifle.

When out hunting, one rarely saw the dogs, but their owner knew fairly well where they were and could always call them in. Should they have gotten on to the trail of a tokata, they were trained to run him to bay. Unless this was accomplished, however, the chase must ultimately have disappeared in the blue, leaving us far behind.

The natives who were leading us were armed, for the hunt, with spears. These were about five feet long, with detachable heads. The spear point itself ended with one strong barb. Attached also to this spearhead was a cord to the other end of which was fastened a narrow piece of wood about a foot and a half long. Consequently, should a speared tokata attempt to escape into the jungle, trailing the long cord with this small billet of wood at its end, he would immediately become entangled in the underbrush and be held so firmly that he could be easily dispatched by the hunter. On the other hand, speared tokatas have frequently made straight for the hunter, with lowered horns. The numerous scars on one old hunter's legs bore ready testimony to this.

STALKING TOKATA

The small hunting dogs were always active and quite untiring but never too specific about what they might be after. On our first day out there were two moments filled with high hopes. The dogs were certainly giving tongue and we strained every muscle to keep up with them, but the effort proved vain, for they had been on to only a snake and a monkey.

Our hunt was, for the most part, merely wasted effort. Up and down and in and out. Thorns, slippery hillsides, drenched vegeta-

tion, and rarely a place to rest. But at length, after several arduous days, one tokata was speared, and we gladly returned to the village for a well earned rest.

A WONDERFUL COUNTRY

Tenure of land among the natives is in the hands of the head men or petty sultans. Agriculture is carried on entirely by the peasant class, who pay tithes in produce to the owners for the use of the land. Tenants and landlords have always gotten on very well together in good fellowship, for the Toradjas have good reason to be happy, as they are blessed with a truly wonderful country. The rainfall, which is regular throughout the year, is never so severe as to be oppressive nor so mild as to be insufficient for their crops. All this moisture gives the open spaces a beautiful aspect. The natural flora is of a lovely shade of green, and there are emerald paddy fields, innumerable clear, rushing streams, clumps of coconut palms, kapoc, bamboo thickets, myriads of wild flowers, and many different varieties of orchids. Besides this, there are many picturesque gorges, chasms, and precipices.

Due to the elevation, the climate of this region is very pleasant. There is no burning heat about mid-day and the nights are always cool. One is quickly struck by the surprising absence of any insect pests. When going through the jungle, there are no encounters with centipedes, scorpions, red ants, or thick spider webs. Mosquitoes are scarce and there is little malaria and few other diseases. As there are no large members of the cat family or other predatory animals on the island, tokatas have no enemies save man. Traveling about in this country, one sees no sign of poverty, as everyone is occupied in some way, and no droughts or blights ever affect the crops.

This area is easily reached, for new motor roads have recently been put through, and from these, by riding tiny native bred ponies, one can visit many villages. Fortunate are the Toradjas. It is no wonder that one so often sees their faces wreathed in smiles.

A Forest of the Past

One of the natural wonders of the western world is the Petrified Forest of Arizona, in which are trees of a vastly ancient age, turned, in the almost endless years that have passed, to quartz

by

Harriet Geithmann

Photographs by William Nelson

IT was John Burroughs who suggested that we "drop off at Adamana on the rim of the Painted Desert in Arizona" and see the Petrified Forest. As a result of that bit of advice the Santa Fé dropped us off one October morning at daybreak at Adamana on the fringe of one of the natural wonders of the world. There, luckily, Rawhide Bill took us in tow.

On the way over to the inn for ham and eggs we learned that Adamana received its poetical name from the old-timer Adam Hanna himself, Arizona's sheriff, stage driver, herder, and scout of 1889. Adam Hanna's Inn waits on the banks of a chocolate-colored stream called the Rio Puerco, "dirty river." So muddy is this little river as it winds lazily through the desert's sagebrush and Mexican greasewood that nothing can live in it or even drink in it. Even the coyotes bark their disapproval all night long. In the cottonwoods that fringe its banks, Adam Hanna used to hear the orioles and mocking birds. As for us, we saw few birds on our trek, a gaunt raven, a desert sparrow, and a burrowing owl.

After breakfast, Rawhide Hill, cowboy, scout, geologist, and guide, picturesque follower in the pioneer footsteps of Adam Hanna, tucked us into his rattling good car, and off we whizzed in a cloud of dust to pay tribute to the First, Second and Third or Rainbow Forests as well as the Blue Forest. The nearest of Arizona's forests of stone was but a few miles to the south, Jack rabbits,

highly colored lizards and horned toads scurried out of our way.

Presently we were in the fossil forest clinking over chips of agate, jasper, onyx, and chalcedony, Arizona's carpet of gems, rich in color and fadeless. Everywhere were petrified logs but no standing trees. All were prostrate, silent, fallen giants with hearts of jasper.

"Many of these logs," declared Rawhide Bill, "measure from three to thirty feet in length and in diameter from one to four feet."

Everywhere we found broken trunks, cart wheels, stove-lengths sawed off by the gods themselves, cylindrical sections five or six feet in length. The inner sections were colored brilliant reds, yellows, blacks, purples, and lavenders, as were the chips scattered about. Many of the fragments were smeared with "desert varnish" of bright red. On one of the mesas Rawhide Bill showed us the cannon log. In this entire region rich with logs we found few limbs or roots anywhere.

We discovered the prize log, however, in all these forests of solid stone, the most perfect tree, was the log of chalcedony, a bluish quartz, that served us as a jewelled footbridge over a gully on the northeastern border of the forest. This amazing tree of stone, called the Natural Bridge, reminded us of the two Johns, John Burroughs and his guide, John Muir, who roamed through these



Above: The root end of this badly weathered tree in the "Second Forest" has been named "The Lion's Head" because of its fancied resemblance to the king of beasts



Left: "Old Faithful," a large, petrified tree in Rainbow Forest, has a root end seven feet in diameter

A section of petrified log left "high and dry" on a wind-eroded block of sandstone. This entire block has slid about 500 feet down hill from its original position on the rim of the mesa, the slope of which is shown in the background at the right



Right: For years broken sections of petrified trunks like these served as raw material for the manufacture of table tops, paper weights, beads, and pendants



Below: A close-up of a beautifully colored block of petrified wood. This specimen has now been polished and is on exhibit at the local museum. Despite the fact that the tree has been entirely replaced by stone, much of the original woody appearance is still retained



fossil forests in 1909, studying the overwhelming evidences on every hand of time and change. Everywhere the geologist, John Muir, found "beautiful wood replaced by beautiful stone." They, too, crossed this same chalcedony bridge, which is about 111 feet long, 4 feet in diameter at the base, and 18 inches at the tip. This beautiful specimen spanned a ravine 44 feet in width and 50 feet in depth, a gash in the earth between two colorful mesas. Both ends of this great tree were embedded in sandstone. At the bottom of this gulch we saw a clump of cedars and cottonwoods, the only trees in the neighborhood.

Trailing from mesa to mesa, rich in agatized logs and fragments of logs, we were amazed at the variety of color and wealth of beauty. Under the microscope these brilliant cross sections have revealed to the exploring eyes of the geologist the interesting fact that some of these rigid forms *Araucarioxylon* and *Woodworthia* were giant pine-like trees that do not now live in the northern hemisphere.

THE EXTENT OF THE FOREST

The Petrified Forest National Monument, which now includes the Blue Forest as well as the so-called Aztec Ruins, covers about 25,625 acres of gems, some 40 square miles or more, several sections of land, all of which are in the Apache and Navajo counties of northeastern Arizona on the southern border of the Painted Desert which has been but recently added to the reserve. This is the plateau country, the western rim of which is fifteen miles east of the little Mormon town of Holbrook. Through this plateau, which is 5700 feet above the sea at its highest, an arroyo winds among the buttes in a southerly direction. The upper 700 feet of this great plain have been worn down by forces of erosion, atmospheric action of one kind or another, into valleys and gorges separated by mesas and buttes. In the clear, sunshiny air of Arizona these ridges of sandstone, shale, and clay are picturesque because of

their brilliant terra cotta, blue, and mauve. Those colored with red oxide are the most brilliant of all. In some of these mesas, which are being undermined constantly, we found trees in situ, perpendicular columns of stone, pillars of an ancient temple not built by human hands.

THEORIES

An early geological theory in regard to the origin of these forests would have us believe that this great plateau was once an inland sea into which emptied an ancient river. Down this river floated millions of evergreen trees. When they reached the inland sea, they became water-logged and gradually sank to the bottom. In due time these logs were gently covered up with layer after layer of sand and silt as the sea receded or evaporated. This all happened during the Triassic Period in the Mesozoic Era, 200,000,000 years ago more or less. At that time the herbivorous dinosaurs, some of which measured 85 feet in length and weighed 10 tons, were roaming the continent. After the trees were covered by the Mesozoic Seas, they gradually became silicified and their hearts of wood turned to hearts of stone. This geological fact makes the petrified forests of Arizona much older than those of Calistoga, California, Wyoming, and Yellowstone National Park, which are largely credited to the Tertiary Period.

The foregoing explanation has not been proved and there is considerable evidence against the above theory of transportation. A later opinion is that this area was doubtless the bottom of an enclosed body of shallow water supersaturated in mineral content in which all organic remains became agatized, including not only the trees but invertebrates as well. In this particular region, where there were no trees, there are thin sheets, or strata, of chalcedony. Many years ago before the forest was visited to any extent by tourists, *Phytosaurus* and labyrinthodonts and other reptilian remains were common in the vicinity, and they likewise were agatized, whereas in the same stratigraphic position

Right: 200,000-000 years ago—more or less—this tree may have been a bit of the drift-wood on a shore line that was visited by dinosaurs



Left: Buried for millions of years, the Petrified Forest has reappeared as a result of erosion

Below: A typical scene in the Petrified Forest, showing the scattered profusion of logs and sections. Many of the logs, though broken, still lie with their sections in proper sequence



Left: A log emerging from its "grave." The butt end section has slipped down hill a trifle, owing to the erosion of its support



Below: A natural bridge in the making. This large tree is precariously supported by two marl hills, the gully being almost ready to carve its way under the log



Below: Agate Bridge must at one time have been a twin bridge, for the remnant of another log remains in the sandstone at the right-hand side of the picture. At some time in the past this other log must have broken into pieces, and its remnants have been swept down into the arroyo beyond





Above: A large and very well preserved tree in Rainbow Forest. Though changed to stone, the appearance of the tree has been most faithfully retained



Below: This section of a hollow log has been petrified as faithfully as other sounder trees have been

Above: The effects of weathering. The tree in the foreground has been exposed to the weather so long that it is badly disintegrated, while the one in the background, having been more recently exposed, is still fairly well preserved.





At the left a petrified log is shown supported by a narrow ridge with practically no footing on either side. A little more erosion will bring about the fall of this fossil, when, undoubtedly, it will be broken into many fragments



The "woody" exterior of the sections shown above is clearly apparent. At the right appear the "Twin Sisters"—an odd name, for there are three of them. The largest of these measures about 100 feet in length



on the Little Colorado River equally abundant woods and animal remains are silicified but not agatized.

Aeons later the beds of sandstone and clay in which the conifers were embedded met with upheaval. Gradually they were put under great strain and stress and raised to their present altitude, a mile above sea level. In due time the sand and shale surrendered bit by bit to atmospheric forces. Logs, sections of logs and shattered fragments of logs, all of quartz which resists erosion longer than any other mineral, were revealed everywhere. Scientists believe that the forests represent immense conifers which millions of years ago swayed in the wind, trees that towered from 100 to 200 feet in height and measured from 2 to 4½ feet in diameter.

VANDALS

Roads and trails now crisscross Arizona's carpet of gems. Thousands of Americans and their cousins from afar visit these fossil forests every year. Among the visitors there are naturally many vandals who stop to plunder as they slide through. They are not content with picking up a chip here and there to serve as a precious paper-weight, but they must smash large specimens to bits in search of brilliant fragments of jasper, onyx, and opal. Relic hunters are they, laughing at law and order as they carry off the forest piecemeal. Men from the four corners of the earth have already shared the treasures of these fossil forests. The Zunis supplied themselves from the forest years ago with material for objects both of use and ornament, pestles, arrowheads, hammers, knives, and charms. Even the houses of

certain Indian villages in the neighborhood of the forests were constructed out of precious logs of chalcedony. Great table-tops and pedestals from the Petrified Forest of Arizona may be found in the Shell Room of the royal woodchopper's former palace at Potsdam, where the walls and ceiling are a shining mosaic of minerals, polished stones, and shells. Skidding across the waxed in-laid floors in felt slippers that reminded us of snowshoes, we found this room of Mr. Hohenzollern a geological treasure house flashing from corner to corner with trophies from land and sea. At the World's Fair were more logs, polished slabs, table-tops, clock-cases, mantles, and pedestals from these same fossil forests. Even jewelers and manufacturers of emery substitutes have not overlooked the forests entirely. Ever since John W. Stedman heard of these forests from the lips of the Zunis and visited them in 1851, the first white man to do so, and especially after the opening of the railroad in 1880, they have been treasure-trove to every passing guest afoot or awheel. All of the material remaining in the field has now been set aside as a part of the Petrified Forest National Monument.

After trying to solve this geological puzzle with the help of Rawhide Bill and his pet theories, we left the desolate ruins of the ages and turned back to Adam Hanna's Inn on the banks of the Rio Puereco which is even now spanned by a worthy bridge of concrete, a solid link in the modern highway system of the fossil forests. Thrice glad were we for having followed not only the advice of John Burroughs but his footsteps as well across Arizona's magic carpet of gems.



The Pottery of Pre-Columbian Central America

by

George C. Vaillant

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American Museum

The last of a series of articles on native
Central American art

THE potter's art in Central America reveals an extraordinary development of imaginative skill. It seems little bound by those set requirements of ritual which governed artistic expression in the arts we have considered in the five preceding articles. Humble as are the uses of pottery, an almost infinite invention is displayed by the multiplicity of forms and decorative styles. The work in clay suggests that here the oppressive grasp of religion was relinquished, releasing the fancy thwarted in other directions. No other part of the world, China not excepted, shows such diverse forms and decorations as their displayed by pre-Columbian ceramics in the area between Chile and the Rio Grande.

In Central America, as elsewhere, the invention and practice of agriculture relieved man from his unremitting search for food, since the harvest created a store to satisfy his needs for months to come. The leisure thus gained gave him a chance to use his mind in directions other than the hunt, and led to the series of inventions and intellectual conceptions which culminated in the handful of great World Civilizations. One of the first steps taken by the early farmer was to devise means of conserving his winter food supply and of preparing it for palatable consumption. In the attainment of these ends, the development of containers of baked clay played a significant and highly important part.

Apart from its importance as an invention, pottery has a more complete historical record than any other phase of early culture in Central America. The hardness of baked clay renders it relatively immune from the destructive action of rot or fire, which have so affected textiles and wooden objects. Even when a vessel is broken, the fragments survive among the ruins of a building or in the village refuse heap. The lack of intrinsic value secured pottery from the cupidity of invaders, greedy for treasure. The common household functions of ceramic products cleared them of the stigma of heretical barbarism, which impelled the Conquistadores to destroy so much of the native religious art in Central America. The usefulness of pottery made it a usual equipment for the dead in their life beyond the grave, so that many complete examples have been conserved in burials, to satisfy later the rapacious curiosity of excavators. Thus the study of pottery, because it is both prevalent and indestructible, has become the backbone of archaeological technique, and by means of the local and tribal decorative styles it is possible to trace the history of early peoples by the fragments of their vessels. Unfortunately, the involved descriptions of pots and pans, which in consequence fill professional reports on excavations, effectively quench whatever interest the layman might take in them.

To absorb the full beauty of Central American ceramic form and design, one must look beyond the borders of the Greek æsthetic ideal. The exquisite shapes of Greek vases resulted from the harmonious



This vase from Miahuatlan Oaxaca represents Macuilxochitl, the Mexican god of games and feasting. The simple lines of the vessel throw into vivid prominence the lively figure of the divinity. The design on his loin cloth and his necklace of gold and jade are faithfully represented

Ceremonial Vessel
from Mexico

Left: This vase from Tepic, Mexico (after Lumholtz 1902) represents a turkey. The wing feathers and wattles of the neck are picked out in gold leaf

Below: Guatemala was the source of this elaborately carved vase (after Saville 1919) which is a masterpiece of Maya ceramics



Below: The glazed effect of this type of Salvador pottery was so greatly admired in ancient Central America that it was traded far and wide. This delightful example shows how successfully the potter animated the vessel by the use of a few simple lines





Above: This sturdy jar from western Mexico illustrates the architectural proportions of much Central American pottery. Structure is stressed, rather than concealed, as Central American art is relatively little concerned with ephemeral grace

Below: The pottery of Costa Rica is often lavishly ornamented, but in these examples painted designs are used to emphasize simple effigy forms. Note how the jars are supported in one case by a tripod, in the other by an annular base



Above: This vase from one of the earliest Central American cultures shows how excellent decorative effects could be attained by the use of a lustrous surface and a few simple lines



principles devised to govern the proportions of their vessels, but lovely as were the results, these formulæ restricted the range of forms. Central American pottery, in contrast, seems completely without such laws, so varied are the shapes. A more detailed examination discloses, however, the operation of rigorous local customs to which the potters strictly adhered. As the pueblo, or town, was the chief unit of group organization, there arose almost innumerable local styles, differing widely from one another and giving to the whole of Central America the effect of æsthetic anarchy, so far as pottery is concerned.

While the shapes of Greek vases give the effect of defeating gravity by their graceful upward curves, the Central American potters seem to stress the difficulty of keeping their vessels erect. The greatest dimension is apt to be horizontal, rather than vertical, and emphasis is placed on the support which in the smaller vessels is usually a ring base or three or (less commonly) four legs. So constant is the use of a low center of gravity that vases with the "soaring" quality of the Greek urn are almost unknown. It is possible that the technical difficulties of building up a vessel with strips of wet clay may have necessitated a more solid structure than that demanded by the more rapid Greek process of throwing up a vessel on the potter's wheel.

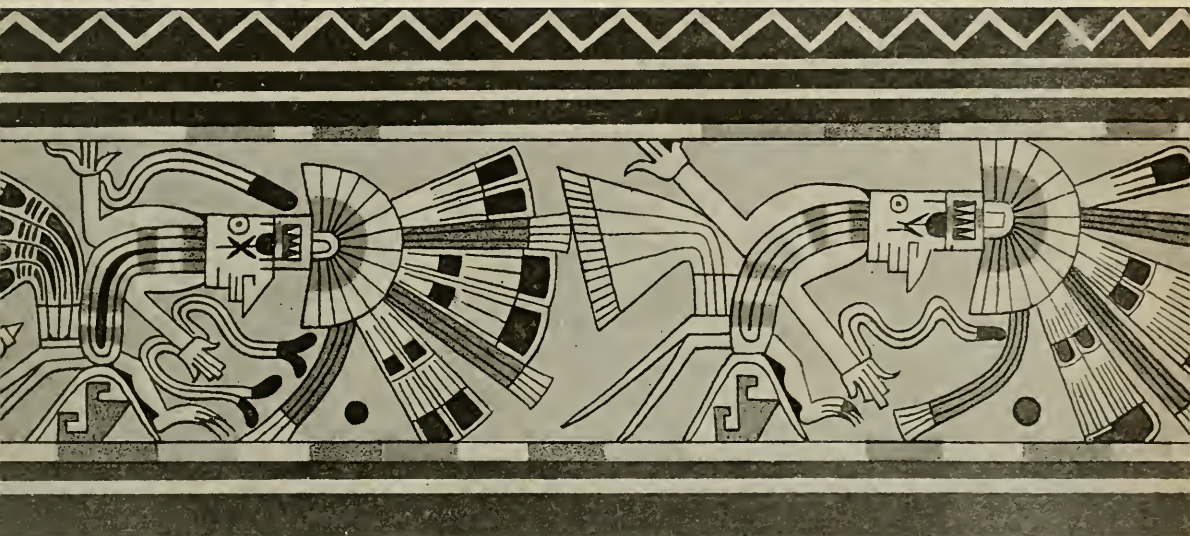
The shapes of Central American pottery are as eminently satisfying as the forms of natural objects. Some bowls are almost spherical and others have the form of a pear. Cylindrical vases of varying dimensions express a delicate grace if tall and narrow, or practical solidity if short and wide. By curving the walls slightly inward or outward, beautiful variations are obtained. Again, a bowl may be grooved to give the effect of a gourd, or else ridged spirally to bring up the high lights on its surface. Many vessels are made in two sections, a wall and base, and, by increasing the size of one or the other, not only are various delightful proportions attained, but also fields are created for a rich

variety of decorative effects. In western Mexico occur especially attractive forms, which involve a curved base, with an almost horizontal shoulder, out of which protrudes a flaring neck.

The simplest form of decoration is to polish the exterior of the vessel. The methods of firing the pots seldom produce an absolutely even color, so that the glossy surfaces suggest the tones of polished fruits or the glossy coats of animals. Black, for example, is seldom jet black, but more the shade of well-used walnut furniture. Reds range from the brown tones of a russet apple to the solid shades of red peppers, dried and polished. Browns merge into black at one extreme and dwindle through imperceptible gradations to a matt yellow. Warm orange tones characterize the clays of several ceramic families, while others show steely gray shades. Such lustrous tones enhance the pure forms in a way that painting never can.

There are numerous cases of effigy vessels, where in the simplest stages, a head, limbs, and tail, added to the pot, give it a pleasingly alive appearance. Sometimes the head alone is added and the anatomical details are incised. In extreme cases the animation of a pot is carried so far that it becomes a sculpture in clay, like the figures of western Mexico mentioned in a previous article. The most consistent use of effigy pottery is in the Plumbate Ware of Salvador, which has a vitreous surface and is the nearest approach to true glaze in Central America.

Since the tripod support was so important in keeping a vessel on an even keel, the Central American potter gave vent to his imagination in constructing this useful adjunct. One way was to make the legs hollow and insert pellets of clay, so that they became rattles. Often the supports were modeled into imitations of animal or human legs, and sometimes, in Costa Rica, Atlantean figures supported the bowl. The modeling of bird and animal heads was also thought a suitable means of transforming a functional necessity into an ornament. When a ring base was used, it was often



Mexican Design

The sources for Mexican pottery designs are many and varied. In the upper right hand picture the purely conventional *greccque* is used, whereas the vase at the lower right is ornamented by the hieroglyph for one of the days of their month, which is a conventional representation of the reed. The jar at the upper left is ornamented in plaster cloisonné, and the central band (after Lumholtz 1902) reproduces the design from a similar vessel. Such stylized human figures are rare in Mexican ornament





Above: This cover from a Zapotec incense burner shows the transformation of a vessel into a ceremonial sculpture



Left: The incensario at the left is much restored and comes from the Teotihuacan culture of the Valley of Mexico. It shows the building-up process utilized in this class of religious vessel

Below: This clay mask from Vera Cruz is a simple and straightforward piece of sculpture, yet it may have been used in connection with some elaborate creation like that on the left





Above: This life-sized figure from the Valley of Mexico is a remarkable technical achievement, requiring great skill in building up the sections so that they would not collapse of their own weight



The head at the upper right was one of a pair of effigy vases found with a burial of the Mazapan culture at Teotihuacan. Although treated sculpturally it is none the less a container. The large figure at its left, and the seated figure from Nayarit are pure sculptures. The photographs on these pages show in striking fashion the contrast between convention and naturalism in Central American art



painted or carved, and sometimes by closing the bottom, it was converted into a rattle.

Two other methods of decoration were in general use. One was to produce a decorative effect on the surface of the pot by incision or applying bits of clay. The second was to add a painted design. Which of the two was the earlier there is no means of knowing, since no really primitive culture has yet been discovered in Central America. If the Southwestern United States, which show the transition between hunters and agriculturists, produce painted designs as the earliest ceramic decoration, the Argentine and the Eastern United States contain primitive tribes who incised and stamped their rude vessels. Therefore, in describing Central American ceramic decoration, we cannot follow an evolutionary plan.

Incising and carving the surface of a bowl were especially common. The cruder examples, from the earliest cultures yet found, show simple geometric patterns made sometimes after sun drying and occasionally after the pot was baked. A striking development of this process was the Teotihuacan method of *champlevé*, in which, after a vessel had been fired and burnished, the polished surface was cut away to leave a figure in relief. Sometimes the effect was enhanced by rubbing red pigment into this roughened background. Some of the finest reliefs in the Maya country may be found on carved vases of this type from Yucatan, where great skill in sculpture and drawing raised the *champlevé* work from the secondary field of decoration to the primary one of Fine Art.

A type of decoration which is found in western Mexico and perhaps derived from this work in *champlevé* approaches the technique of *cloisonné*. In the Mexican examples a completed pot was covered with plaster and the desired design outlined by scraping the soft exterior down to the original surface of the pot. Into these scraped zones, plaster strips of different colors were laid, creating a harmonious, if fragile, decoration. Another method of ornament involved a covering of plaster,

which was then painted in fresco. These plaster decorations could not have survived daily use and must have required special treatment for mortuary or ceremonial use. In fact, in several examples, a painted design has been concealed by a covering of fresco or plaster *cloisonné*.

Another decorative style consisted of pressing a stamped design on to the wet surface of a bowl. This process, when repeated, gave a symmetrical series of ornaments in relief or *intaglio*. Even commoner was the attachment of decorative elements made in molds, which might represent floral patterns, human and animal heads, or else purely conventional designs. Clay vessels were sometimes touched up with gold leaf, like the celebrated Tepic effigy vase, and clay beads treated in the same way were thrifty imitations of the real thing.

Painted decoration involved a prevalent use of geometric design. As we have suggested in the section on Crafts, there is very strong evidence that the textile art with its complementary ornamental patterns was developed long before pottery. Since, in the Southwestern United States the designs painted on pottery are in direct imitation of the earlier basketry patterns, there is considerable likelihood that this practice was quite general in the New World. There was no orderly evolution of design from naturalism into conventionalization. The use of naturalistic elements appeared late, strictly governed by the requirements of harmonious design.

The arrangement of the design in most localities was in panels. Frequently these design units, when on the outside of the bowl, were arranged in threes, so that a complete pattern could be seen. This principle is based on a "rule of thumb" geometry, since a little less than a third of a cylindrical body can be viewed from the side. Continuous patterns, except for borders, are much less common. Besides the steps, grecques and volutes of geometric design, there were also conventionalizations of natural forms. Flowers, animals, hieroglyphs, religious sym-

Elaborate painted designs come from the Maya country. The two circular patterns (after Merwin and Vaillant 1932) adorned a plate and a bowl cover from Holmul, in the Peten district of Guatemala. They are in polychrome



Below: The realism of the two Maya vase paintings is skilfully adjusted to decorative needs. Extraordinary as is the fancy shown in their creations, the two designs from Cholula bowls are equally original in conception. The pattern shown in the central rectangle was inspired by a feather headdress placed against an ocelot skin, and the decoration below utilizes a feather fan



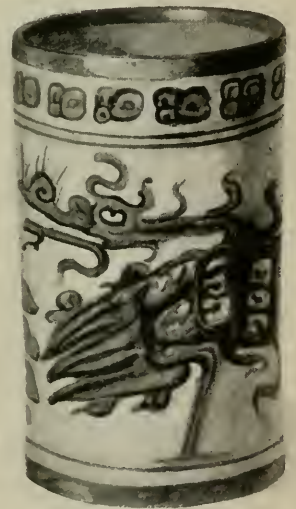
Maya Pottery Designs



Left: The Maya used their script in decorative fashion. This vase from Guatemala, like the Holmul plate on the preceding page, utilizes bands of glyphs to divide off design fields



Below: The conventionalized pelican on this vase is carried out in red tones on a white background. This and the upper vase are after Gordon 1925



Left: This vase from Salvador is ornamented by designs in black and orange on a yellow field, while the Maya bowls on the preceding page show similar uses of warm red and orange tones with black outlines

bols, were cunningly treated to make decorative effects. In the Maya pottery of Copan and Salvador the monkey was often used, since its elongated arms and tail were readily adaptable to the needs of design.

The colors include shades of white, red, yellow, orange, black, with occasional uses of blue and green. The disposition of the colors usually involves one for the background, another to outline the design, and a third to fill the patterns. Sometimes when realistic elements like a headdress or a butterfly are portrayed, they are used naturalistically. The fullest use of naturalism in color and design is in the celebrated "picture" vases from the Maya country which we have considered under Painting.

Besides pottery vessels, the work in baked clay extends to many other types of objects. The figurine cult, which contributes so much to the plastic art of Central America, absorbed much of the potter's inventiveness. Spindle whorls, the weights used for the wooden shafts in spinning cotton, become, in the hands of Central Mexican clay workers, beautiful little creations, with their lustrous red or black slips and delicately worked reliefs. The stamps for adorning cloth or the skin, are often of clay, and represent in their cutting skillful judgment of balanced design. Musical instruments like whistles, flutes and ocarinas require of the potter a knowledge of the physical properties of tone, while the cylindrical drums of Central America are often beautifully ornamented by carving or painting. A curious musical instrument, very rarely found, is the whistling jar which gives out a note by the air expelled when the liquid is poured out. The massive incensarios, used to burn incense before the temples, are as imposing from a structural point of view as from one of ceremonial art. Pipes, used presumably for ceremonial smoking, since cigarettes and cigars were the usual method for consuming tobacco, are frequently exquisitely polished and very well proportioned. Censers or incense ladles often received treatment

comparable to the best of the ceremonial art.

The relationship of these Central American clay forms to the art of the present day brings one face to face with the besetting difficulty of modern European art. We are in an age of revolution, intellectual and artistic as well as political and technical. There is a tendency to abandon individualism for group action, and, in the fields of architecture and the decorative arts, function and the relationship between the material and the form tend to suppress the individualism of the craftsman's personal expression. The copying of alien art forms is arid when it is not jarring, so that it would be stupid to utilize in our art today the *content* of Central American æsthetic expression. On the other hand, the impersonality of Central American art, which expresses a mass life under divine direction, dovetails well with our modern disciplines under mass production and mass movement.

The Chicago World's Fair, intended for the absorption of millions of people, produces the anonymous effect of the work of thousands of artisans and engineers, but not the genius of an individual. Much this same spirit permeates the art of Central America. The principles of design and form are no less inherent in our discipline by graph, blue print, and mathematical formula than in the ancient Central American rule by ritual.

This article and the five preceding it have been intended to show the various aspects of Central American art without insistence on the complicated historical background. The relationship of the individual Central American to his art, we can probably never know precisely, although we can be certain it was not æsthetic in our modern sense of the word. On the other hand, we moderns can extract a great deal of pleasure, even inspiration, from the contemplation of the works of these gifted people, if we lay aside the tenets and traditions of our past art history to examine Central American art from the viewpoint of our modern industrial age.

The Loch Ness "Monster"



by

William K.
Gregory

Curator of
Ichthyology and
Comparative Anatomy,
American Museum

Surprised in the act of stealing a sheep the "Monster" indignantly asserts his ancient prerogative of making forays and collecting tribute from the helpless country-side

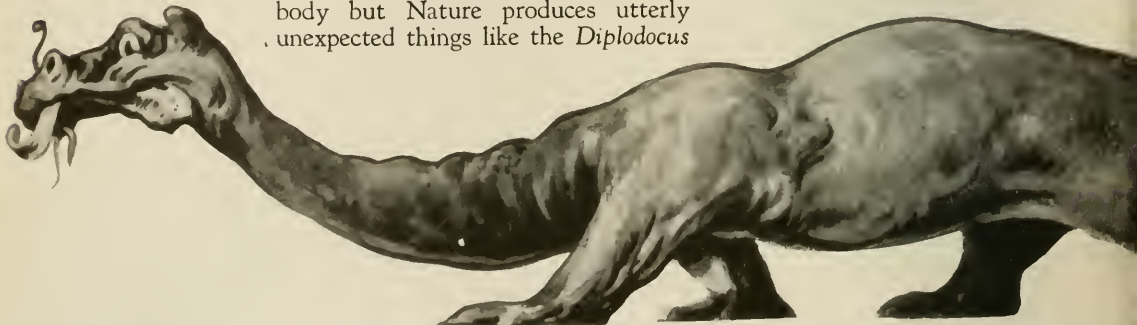
ON a recent trip to the north of Scotland I stopped off for a while at Inverness, which is the home port of the "Loch Ness monster." Inverness is as romantic and beautiful as only a Scotch city can be, with its castle and kirk and verdant hills. A swift-flowing stream carries the clear waters of the long, narrow Loch Ness northeastward to the Moray Firth. So I stood thoughtfully on the suspension bridge underneath which the Loch Ness monster must have passed if it came in from the North Sea. At that time the water was pretty low, but in time of flood a good-sized

seal or even a killer whale might easily have passed up into the Loch in pursuit of salmon.

The latest "photographs" of the "monster" look like the dorsal fin of a killer whale.

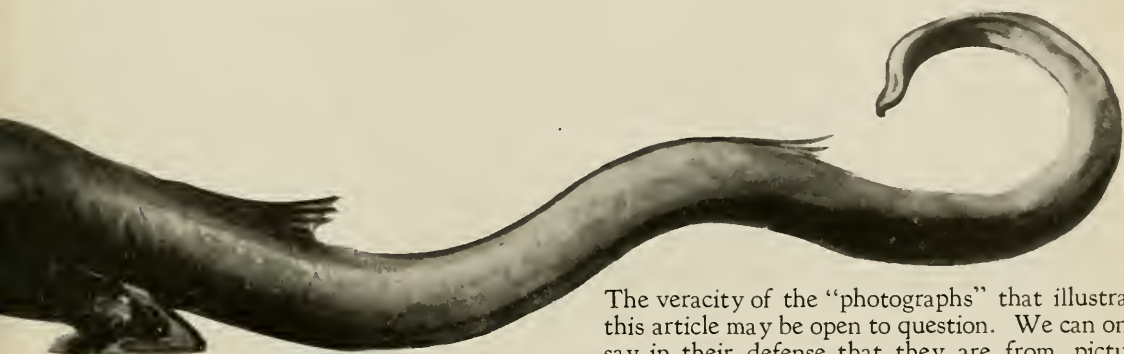
One hesitates to contradict twenty million Scotchmen, especially on their home grounds, but I noted for future use that "*Nessum monstrosus*," as the animal has been facetiously named, must be a creature of protean form and varying proportions. In a guidebook to Loch Ness it is described and figured as an overgrown edition of the Japanese "giant salamander," which is a four-foot mud puppy with a head that has

The trouble with this "monster" is that he is too plausible to be honest. Nobody but Nature produces utterly unexpected things like the *Diplodocus*





This obliging beast shows off his mammalian face and hind feet combined with reptilian scales and tail



The veracity of the "photographs" that illustrate this article may be open to question. We can only say in their defense that they are from picture postcards purchased by Doctor Gregory in Inverness



Two "monsters" in a single loch. A sinful waste of native talent

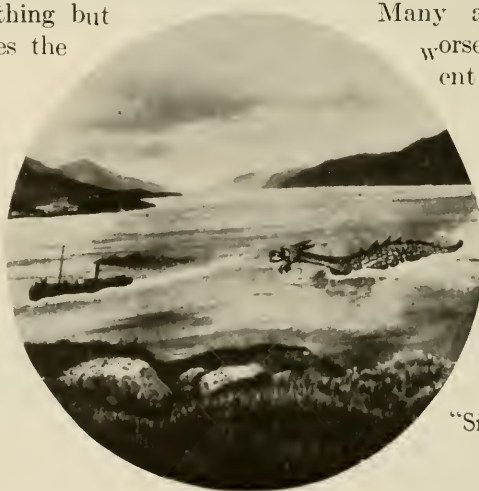
Why do "sea-serpents" insist on throwing their bodies into vertical coils, in a manner so mechanically futile?



been flattened as if under the foot of a behemoth. Another voracious artist, however, represents the head as long and narrow, but with a giraffe-like tongue. Unfortunately, the lower jaw is not articulated at the posterior end. A third depicts the monster as emerging from the Loch and looking like a feeble libel on Charles R. Knight's well known restoration of *Allosaurus*. A fourth imaginative genius has produced a masterpiece by combining the features of several reptiles and mammals with the back fins of a teleost fish. But nothing but the *corpus delicti* satisfies the relentless scientist.

The fair city of Iverness teems with souvenirs of its beloved monster: postcards *ad lib.* in the Scotch equivalent of the "Five and Ten," little bronze monsters in the jewellers' shops, wooden monsters for the bairns to ride upon, and rubber monsters to take in bathing in the already chill waters of the Loch. And the silver tide of tourists still runs high. Surely the good beast is the greatest benefactor of his country since Sir Walter Scott. But why pick on Scotland for this innocent and profitable amusement?

Many a country could show worse pastimes in the present period of world history.



"Sic 'em, Rover"

Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by
A. Katherine Berger

The Sage West China Expedition

Mr. Dean Sage and his wife, Mrs. Anne Tilney Sage, joint leaders and sponsors of the Sage West China Expedition, left New York City on June 29 for Western Szechwan, China. The expedition hopes to collect specimens of the giant panda, takin, and golden monkey, and will, of course, make such collections of the mammals and birds of the region as time will permit.

Mr. T. Donald Carter and Mr. William G. Sheldon were detailed by the American Museum to accompany the expedition. They left in advance of Mr. and Mrs. Sage, on April 23, 1934, in order to make the necessary arrangements for arms permits, passports for the interior, et cetera.

The department of mammals is in receipt of a letter from Mr. Sage, dated Shanghai, August 11, 1934, in which he advises "this morning the final papers arrived from Nanking, and we shall be off up river on the next boat. All the information we can get is to the effect that the fall months are the most favorable ones for collecting in Western Szechwan, and we are highly hopeful of what we may accomplish. . . . The Chinese Museum people here have been more than good to us, and the Director General of the Academia Sinica has given permission for all our staff to go out. . . . He is a very able scientist by the name of V. K. Ting. . . . Now that we are out here, I must say that I wish we could stay for a year or so instead of only a few months! There is much interesting work to be done, and always the lure of Tibet and the country just north, where we are told that the Tibetan grizzlies are to be found in numbers."

The Scarritt Expeditions to Patagonia

One of the aims of the Scarritt Expeditions of 1930-31 and 1933-34 to Patagonia was to seek the oldest mammals of South America. In this the expeditions were remarkably successful, finding remains of older extinct mammals than any known before from that continent. These extremely important small fossils are now being studied, and they prove to represent a whole new fauna, the most primitive of Patagonia and forerunner of the amaz-

ingly exotic and strange later extinct animals most of which were described by the great Argentine paleontologist Ameghino. The new geological formation, older than the Casamayor from which came Ameghino's oldest mammals, has been named the Río Chico Formation, and its fossils will soon be named and described in scientific publications of the American Museum.

Dr. Egidio Feruglio, the Italian geologist, who has done much valuable work in Patagonia and assisted the first Scarritt Expedition there, has forwarded his collection of Patagonian fossil mammals to the Museum for study and identification.

—GEORGE GAYLORD SIMPSON

Archæological Material for the American Museum

Mr. N. C. Nelson, curator of prehistoric archæology in the American Museum, visited Yellowstone Park for two weeks this last summer, and engaged primarily in research for archæological material, of which a small collection was obtained from camp sites and the shores of Yellowstone Lake. He also visited the region around Austin, Texas, and in the company of Prof. J. E. Pearce, examined a number of so-called burnt-stone mounds which for a number of years have been yielding extremely interesting chipped stone implements. A small collection of these was obtained.

During the summer a very interesting collection of pottery and skulls was sent to the American Museum by a missionary friend of Mr. Nelson's from the Kasai District, Belgian Congo. They were found in a cave which some fifty years ago served as a temporary refuge for the people of the locality when they were being attacked by a neighboring tribe.

Astronomy

The curator of the department of astronomy, American Museum, takes great pleasure in announcing a most generous gift to the department from the United States Naval Observatory, through its Superintendent, Captain J. F. Hellweg. Captain Hellweg has presented to the department five large transparencies of the August, 1932, total solar eclipse. Four of the transparencies show the corona and prominences during totality, and the fifth shows the equipment of the United States Naval Observatory expedition. These transparencies have been in-

stalled in the Pro-Astronomic Hall at the American Museum.

The astronomy department has also acquired another valuable gift, but, unfortunately, through the sad death of a loyal friend to the Amateur Astronomers Association and the department. For several years the department has had the privilege of using a 3-inch refracting telescope, lent by Mr. B. T. B. Hyde of Santa Fé, better known to thousands of nature lovers as "Uncle Benny." Early this spring "Uncle Benny's" friends were shocked to hear of his sudden death. When the curator of astronomy was in Santa Fé this summer, Mrs. Hyde most generously presented to the department this fine telescope, saying that she knew "Uncle Benny" would approve of this disposition of the instrument.

Daily ten-minute talks on the Solar System are a new departure inaugurated by the department of astronomy. These talks take place in the Pro-Astronomic (Eclipse) Hall daily except Sunday at 2, 2:30, 3, 3:30 P.M.

The officers of the Amateur Astronomers Association are pleased to announce the lectures for the coming year. They are trying a new experiment this season, incorporating into the year's lectures three series of three lectures each, believing that this may give a valuable continuity in the series. Dr. Clyde Fisher opened the year on October 3rd with a talk on the "Nebular Theory," the first of his three talks on "Cosmogony." His second talk, on October 17th, was on the "Planetesimal Hypothesis." Following is the list for the remainder of the year:

| | | |
|-------------|----------------------------------|--|
| November 7 | DR. CLYDE FISHER | "Cosmogony—Modern Developments." |
| November 21 | DR. J. H. KIMBALL | "Aërial Navigation and Meteorology." |
| December 5 | DR. O. H. CALDWELL | "The Astronomer's New Tool—The Electron." |
| December 19 | MR. CHARLES A. FEDERER, JR. | "Stellar Diameters—Luminosities and Temperatures." |
| January 2 | MR. CHARLES A. FEDERER, JR. | "Stellar Diameters—The Interferometer." |
| January 16 | MR. CHARLES A. FEDERER, JR. | "Stellar Diameters—Giants and Dwarfs." |
| February 6 | DR. R. E. LEE | "This Wobbling World." |
| February 20 | MR. STANSBURY HAGAR | "Constellations of the Mayas and the Mexicans." |
| March 6 | DR. E. E. FREE | "How and Where Astronomy Began; Hours and Days among the Sumerians of 6000 years ago." |
| March 20 | DR. E. E. FREE | "The Great Days of Astrology; When Star Watchers Were the Best Advisers in Economics." |
| April 3 | DR. E. E. FREE | "Is Astrology Still Useful? The Real Relations of Planets and Birth Dates to Health, Success and Happiness." |
| April 17 | DR. PALMER H. GRAHAM | "Comets." |
| May 1 | MR. DAVID B. PICKERING | "Variable Stars." |
| May 15 | ANNUAL MEETING. MOTION PICTURES. | |

These meetings are open to the general public and anyone interested is most cordially invited to attend.

The officers of the Amateur Astronomers' Association are also happy to announce that again this year there will be both elementary and advanced classes in astronomy, and an amateur telescope-making class for members of the Association. Information about the activities of these groups may be

obtained by writing to the secretary, Miss Marian Lockwood, at the American Museum of Natural History.

Flying Fishes Visit New York Waters

The inshore water off New York seems to have been unusually warm in the late summer and early fall of 1934, and off-shore warm-water surface fishes seem to have been more frequent than usual. Tuna fishermen have found the ocean bonito (*Gymnosarda pelarmis*) which ordinarily follows flying fishes on the high seas, along with the tuna, and there are rumors of flying fishes near by, and one definite report of a short-winged flying fish (*Parexocoetus mesogaster*) picked up alive from the edge of the water at Atlantic Beach, Long Island, on September 13 by Robert Arbib, Jr.—J. T. N.

The Isle Royale Moose Herd

In 1911 no moose were known on Isle Royale, famous fifty-mile-long copper island, lying near the Canadian shore of Lake Superior. During the winter of 1912–1913, which was particularly frigid, the channel between Isle Royale and the north shore froze over. Over this bridge came the moose, and in an environment free of all predators—for wolves and bears are unknown on Isle Royale, and man did not winter there—multiplied by leaps and bounds. Reports soon came out that moose were overbrowsing the island, and an investigator from the University of Michigan estimated that in 1930 the island held no less than one thousand of these animals. Recently, the island has been proposed as a National Park, largely to guarantee the future of the island as a moose reserve.

This summer Dr. R. T. Hatt of the American Museum visited the island to obtain first-hand information concerning the reported condition of over-population. There he found the moose forage extremely impoverished; water lilies and ground hemlock, two favorite moose foods, had disappeared. Cove bottoms, where moose fed, were barren of plant life within the reach of the moose. Seventy-five per cent of the poplars in some areas were stripped of bark. Mountain alder, huckleberry, and birch seedlings were trimmed down to the level at which a moose can conveniently feed. Moose beds and trails were everywhere. It was usual to have moose feeding morning and evening in plain view of camp. Moose were so abundant that seeing them was not much more exciting than watching cattle at pasture. At one of the resort hotels, guests are led out to see the moose at a salt lick, much as tourists in Yellowstone are taken to the dumps to see bears. And the guests are not disappointed. It is common for fifteen moose to come around at the time of a visit.

If the landscape and the moose are to be preserved, the Conservation Department of the State of

Michigan in whose hands the island herd rests, will need to take immediate steps greatly to reduce the numbers of moose. The first culling, which must be drastic, will probably require the use of guns. Eventually, it has been suggested, wolves, bear or mountain lion brought to the island may help to keep the herd nearer an optimum size. Then, perhaps, the summer visitor may not be able to boast of how many moose he saw but will get something of a thrill when he does see one—or one of the even more interesting flesh-eaters.

Fluorescent Minerals

A new exhibit illustrating the effect of fluorescence in certain minerals has been installed in the northwest corner of the Morgan Hall in the American Museum. This exhibit is contained in a standard upright case of the type used in the Morgan Hall, but with opaque top and sides. The fluorescent minerals are placed on black steps and viewed through a window in one side of the case.

The ultra violet light is furnished by a Nico mercury vapor tube presented to the department by the New York Mineralogical Club.

Over the window is lettered the following explanation:

This case contains a group of minerals that exhibit the physical character known as fluorescence.

When exposed to direct radiation of ultra violet (invisible) light rays, they glow with variously colored light emitted from within the mineral as exposed.

Only certain species of minerals exhibit this phenomenon, and of these only varieties found in certain places are fluorescent.

An automatic switch changes the illumination of the case from ordinary electric lighting to ultra violet radiation and back again. While the white light illuminates the case an inside label reads:

These minerals are now illuminated by electric light. The electric light transmits light of all colors. The colors of the minerals are therefore those of the color of the light they reflect; the other colors being absorbed by them.

Watch the light change

Upon the change to ultra violet radiation, the letters of the foregoing label disappear, and between the lines the following appears in fluorescent letters:

Invisible ultra-violet rays are now falling on these specimens. These minerals have the property of absorbing the ultra-violet rays and stepping them up to a wave length of visible light. The new light, created within the minerals from the ultra-violet rays is emitted as a cold glow.

Watch the light change

Specimen labels written in black and fluorescent inks are also readable under the changing light.

—H. P. WHITLOCK.

Natural History Objects from the Upper Amazon

Dr. Harvey Bassler, recently appointed research associate in the department of amphibians and reptiles at the American Museum, has returned from Iquitos, Peru, with a large collection of natural history objects brought together during twelve years of field study in the out of the way places of the upper Amazon. Doctor Bassler is planning to remain at the Museum for some months while study-

ing his unsurpassed collection of South American reptiles which he recently presented to the Museum.

A New Form of Fossil Antelope

Messrs. Quentin Roosevelt and J. W. Burden the past summer discovered in a cave of southern Arizona two partial skulls with other remains of a new form of antelope of the pronghorn group. Previous to returning to school at Groton they have supervised the preparation of this material in the American Museum, and are publishing a preliminary description of the same in *Novitates*. "We encountered the first sign of fossils, a small bone projecting from the ceiling, on our way out of the cave on the first day. The explored part of the cave consists mainly of a large cavern 30-50 feet high, of grayish limestone, into which opens two entrances and the mouth of a long tunnel. It was at the mouth of this tunnel that the second bones were found, and it was here that we first commenced operations and secured the only mandibular ramus. Later at the spot where we had first noticed the bone in the ceiling, we worked for three days with the result that we uncovered two skulls, a pelvis, some vertebrae, and numerous limb bones. The fossils were embedded in rubble, which consisted largely of limestone fragments and hardened clay. The floor of the cave to great depth was made up of rich dark earth permeated with fragments of rock. Some distance down the passage there were stalactites of many sizes and shapes and signs of water erosion. In the main room we found a piece of pottery and a bone cracked by fire."

Fall Program, Department of Education, American Museum

Several new features mark the opening of the fall program of the American Museum. Although more than 32,000,000 contacts were made with children and adults by the Museum last year, plans have been completed for even wider contacts during the coming season.

ACTIVITIES FOR ADULTS.—Free activities for adults will have a prominent place on the program, including lectures and specially arranged tours of the exhibition halls, courses for teachers, astronomical talks and meetings, copies of indoor nature trails to assist in studying and understanding various halls, and a series of 42 radio talks over WOR at 6:30 P.M. on Saturdays, dealing with each of the 42 halls of the Museum, followed by tours the following Saturday to the halls spoken of in the previous broadcast. Weekly programs of Museum events may be had upon application.

The **FREE GUIDING SERVICE** will be considerably enlarged this year. The six general weekly tours conducted by Dr. William Lord Smith at 11 and 3 on Wednesdays, Fridays, and Saturdays will be continued, but in addition a definite program of trips for adults on six consecutive Saturdays at 3 P.M.

has been arranged to study and contrast the habits of various primitive peoples, including the South Sea Islanders, the Eskimos, Pygmies, and Indians of the Americas. The group assembles in the main foyer of the Museum.

Other free Saturday attractions are programs of MOTION PICTURES on history, geography, and nature at 2 P.M. which provide instructive entertainment for both child and adult.

At 4 P.M. on the four Saturdays from October 20 to November 10 a most fascinating series of informal talks on the beautiful new DRUMMOND COLLECTION of jades, ivories, ambers, and other gems is offered by Mr. Whitlock, curator of minerals and gems.

Ten free LECTURES ON BIOLOGIC SCIENCE Tuesdays at 3.40 P. M. from October 2 to December 11 offer much of interest to biology students of any age as well as to the layman. A new plan has been followed this year in dividing the course into two sections, the first for elementary and general biology and the second for advanced.

There will be more extensive COÖPERATION WITH THE COLLEGES AND UNIVERSITIES of the city than ever before. Five free courses for teachers will be given in coöperation with The College of the City of New York and one course for teachers in conjunction with New York University. "Alertness" and college credit will be allowed for each course. Adults other than teachers may take the courses upon payment of a fee. Museum members are admitted free to courses given in coöperation with City College.

AN ENTIRELY NEW OFFERING in this group is the course in "Applied Physiology and Health," dealing with the origin, development, functions, and care of the human body.

"Nature Study for City Teachers," given in coöperation with the College of the City of New York, is designed to help teachers who have been appointed nature curators in their schools and also teachers of elementary biology to recognize specimens in the field or laboratory and to learn something of the interdependence and importance of nature. Because of the overwhelming demand for this course during the past three years, a change of policy has been made this year to permit unlimited registration. The number responding totaled 180.

"Astronomy for Teachers," given in coöperation with New York University, is a cultural course for all teachers or any adult student interested in the subject. Observations with telescopes will be made.

Other courses carrying City College credit as well as alertness credit are a spring course on "The Museum in Elementary Social Studies" and preliminary and advanced courses on "The Mechanics of Visual Instruction."

A number of popular courses in natural history, including astronomy, crystallography, insect life, seashore and pond life, birds, and geology will be

given by well known authorities at the Museum in conjunction with New York University's program of Adult Education.

Four particularly fine LECTURES FOR MUSEUM MEMBERS are being announced for alternate Thursday evenings, starting October 25. World famous explorers and scientists will speak. The Know Your Museum Series for members will differ this year from past years in offering four walks and talks for intensive study of Indian Arts and Crafts as shown in Museum exhibits. These will be on alternate Tuesday evenings, beginning October 30.

ACTIVITIES FOR CHILDREN.—The various activities for children which have been so successfully carried on for many years through the Museum's department of education will be continued with important additions. Free lectures, illustrated with motion pictures and colored slides, on geography, history, nature, and industries will be given for school children on Monday, Wednesday, and Friday mornings from October 8 to December 7. Exhibition Hall Talks are offered to classes from the public schools. A new feature of this series of Exhibition Hall Talks will be a Special Activity Program, affording the child unusual opportunity for self expression along artistic natural history lines. The Special Activities will include FINGER PAINTING as a medium of free expression of the child's impressions in the Museum and of his allied emotions and reactions in the outside world of nature; NATURE CRAFTS, in which the children will create artistic nature designs and objects, modeling, blue-printing, and spatter-printing; and third a class in the technique of making MINIATURE GROUPS of various natural history subjects, such as various races of people in their natural habitat, or of animals in native surroundings. Sight Conservation Classes will be continued by arrangement with each teacher, giving children thus handicapped on opportunity in the Museum classrooms to handle and "see" with their fingers, Museum objects.

The Museum sponsors TWO CLUBS FOR CHILDREN,—the Junior Astronomy Club and the Thoreau Nature Club. The former, now in its sixth year, and open to all boys and girls between ten and eighteen years of age upon payment of a nominal membership fee, has a program of unusual interest for the coming season. Meetings are held on the first and third Saturday night of each month from October to June.

The Thoreau Nature Club was organized to stimulate and direct boys and girls of high school age who are interested in natural science. It offers a program which appeals to a variety of interests, and attempts to promote individual initiative in progressive projects, and individual leadership among its members. Its program is outlined by the club itself and guided by the departments of the Museum. The activities

consist of amateur original research and study and the report of such endeavors at the meetings, definite field study by small groups who report to the club or a general field trip by the entire club, activities which familiarize the group thoroughly with the Museum, and lectures by guests invited by the club. The meetings will be held regularly on alternate Saturday afternoons at 2:30 P.M.

Another interesting series of four talks has been arranged for children of members on alternate Saturday mornings, beginning October 27. Captain Bob Bartlett, Dr. Roy Waldo Miner, and Dr. Raymond L. Ditmars will speak in this course.

New Exhibit for Darwin Hall

The department of living invertebrates, American Museum, is preparing an enlarged anatomical model of the primitive chordate *Amphioxus*, to be exhibited in the Darwin Hall. Extensive dissections and anatomical drawings for this purpose have been prepared by Dr. George H. Childs, under Curator Miner's direction. The completed exhibit will fill an important gap in the series illustrating the comparative anatomy of invertebrates and primitive vertebrates planned for the Darwin Hall and the Hall of Fishes, and is in direct line with the needs of all higher schools and universities.

Distinguished Visitors

H. R. H. The Duke of Saxe Coburg and Gotha, president of the German Red Cross, and Col. Paul Draugt, vice-president of the German Red Cross, accompanied by the Duke's aides, Captain Nord, Baron von Levetzow, and Mr. von Grolman visited the American Museum during their short stay in New York on their way to Japan to attend the International Red Cross Conference at Tokyo.

Miss Midori Torii, staff member of the Torii Anthropological Research Institute in Tokyo, spent three weeks during September and October at the American Museum making comparative studies of Mr. N. C. Nelson's collection of archæological speci-

mens from Mongolia. Miss Torii's father, Mr. Ryuzo Torii, who is an eminent anthropologist in Japan, has collected in Manchuria and Mongolia, and his daughter undertook to make a study of American Museum material for him.

Honors

Pacific University, at its annual meeting of the Board of Trustees held in May last, voted unanimously to confer upon Mr. H. E. Anthony, curator of the department of mammals at the American Museum, the degree of Doctor of Science in honors.

American Museum Receives Animal Painting

One of the warmest friends and supporters of the great outdoor purposes of the American Museum was the late Archibald Rogers of Hyde Park, a trustee of the Museum during the years 1891-1910. As a nature lover and sportsman in the relatively early period of the Wild West he was instrumental in the establishment of the Glacier National Park and was influential in the still earlier establishment of the Yellowstone National Park. After retirement from the Museum Board he spent the remainder of his life in his beautiful country home on the Hudson.

As a memorial to Mr. Rogers and as an expression of their own interest in the Museum, his sons and daughters are presenting to the Museum one of the finest works of the well-known animal artist, William J. Hays. Mr. Hays was one of the few American painters who specialized largely in hunting scenes, and the present gift—a group of buffalo—is one of his largest canvases. It is interesting to recall that this picture was purchased by Mr. Archibald Rogers at auction thirty years ago, at which a representative of the Museum made a bid. It is in fine condition and will be a most welcome addition to the collection of animal paintings already in the Museum. The gift will be a double memorial—to the Rogers family and also to one of the most distinguished animal painters of the older period in America.—HENRY FAIRFIELD OSBORN.

Recently Elected Members of the American Museum

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum.

Life Member

Mrs. HENRY MANNING SAGE.

Annual Members

Mesdames VLADIMIR V. BOBRITSKY, KENNETH C. MILLER, MARTHA B. SCHIRMER, BATT L. SPAIN.

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Rabbi JONAH B. WISE.

Messrs. FRANCIS S. MACILVAINE, HENRY M. SAGE, JR., IRVING SCHMELZEL.

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Misses CORINNE FLANIEN, SHIRLEY FRIEDMAN, DORA MAC INTYRE, BERYL PARKER, KATHRYN C. SALTER.

Reverend PAUL J. SANDALGI.

Doctors JNO. MILLER FRASER, KUNIZO HUKUDA, ALICE M. RUSSELL, HERBERT A. SCHULTE, MINNIE B. SCOTLAND, I. N. PHELPS STOKES.

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Messrs. ANTON F. BAARSLAG, BENJ. BLUMBERG, JULIAN B. CLARK, JR., A. E. CONE, GERALD CURTIN, L. IRBY DAVIS, MAX DRUCKER, JERRY FAIRBANKS, ADRIAN C. FOX, HUGH M. HAMILL, EMIL HELBING, C. D. HUDSON, EDWARD T. KANE, EDWARD H. LEBEIS, JR., HEINRICH LIEDER, JOHN M. MICHENER, CHARLES MONTI, ROBERT KING MOODY, JR., J. B. PANGMAN, ELLIOTT PERKINS, MAURICE RICHMOND, SEYMOUR, H. KINZLER, RALPH H. ROSS, THEODORE SHAFFER, EDWIN S. SEABURY, J. D. SELDON, ALBERT SETZER, JAMES SHAND, FRANK M. SHELTON, LOUIS SHERWOOD, J. FORMAN WHITE.

Reviews of New Books

Recent Publications For Those Interested in Nature

Eskimo Year. A Naturalist's Adventures in the Far North.
By George Miksch Sutton. The Macmillan Co., N. Y.
Illustrated with photographs, and with black and white
drawings by the author.

GEORGE MIKSCH SUTTON is a man of parts. And, like Gaul, his parts are three: he is one of America's foremost bird painters; he is a Member of the American Ornithologists' Union; recently, in *The Atlantic Monthly* and, now, in this volume, he emerges as a "popular" writer about natural history and exploration.

Sutton the painter is here represented only by a series of effective black-and-whites; although he modestly disclaims scientific importance for the volume, the bird student and ethnologist will read and reread many of these pages with unflagging interest; and Sutton the writer shows that he has learned from Sutton the painter the validity of the old saying, "One picture is worth ten thousand words."

He calls the book "a study in human adjustment . . . a study in relationships. But first of all it is the story of a glorious adventure in a glorious country." He has made it all of these things, with eminent success—in spite of the Halliburton touch suggested by his "glorious adventure." It should be hastily explained that the Halliburton touch is misleading!

As the account of a sojourn in the Arctic, *Eskimo Year* is unusually satisfying; the author has a happy flair for telling the reader exactly how he lived. We learn, vividly, of the things he touched, of the things he heard. "The sandy soil was honeycombed with lemming burrows. Whenever I stood still I could hear the little mice gritting their teeth." He recounts, with unlabored drama, the things he saw and it is, perhaps, as a painter with words that he is most successful. Six-year-old Pete—short for an Eskimo name that "was unmentionably obscene"—had never seen a railroad train but, "He had a favorite block of ice out on the harbor where he sat by the hour playing at 'dog-team.' In front of him, their feet grotesquely stuck in the snow, was a 'team' of frozen fox bodies, skins removed. How unspeakably chilly they looked, their pale flesh exposed to the wind, their teeth grinning oddly!"

The things he smelled, and the things he tasted—and ate—make most of the hardships of expository explorers pale into weak discomforts. Before he goes to bed, after half a night of bird-skinning, he steps outdoors and all the dogs in camp raise their voices—"the North Country's national anthem." "Sam got up and came out to make certain nothing was

wrong. We had a cup of tea together. Then I went to bed, taking with me a cake of lavender soap, something I could smell, thereby forgetting the beds of stinking kelp." The Eskimos "have an odd odor, but it is a happy odor." "We ate boiled *oogjook*—seal's intestine—at several meals. In preparing this dish John cut the intestine into three pieces of equal length, put these pieces between the fingers of his left hand, and pulled them rapidly through with his right hand, thus squeezing the partly digested material out. Then he braided the limp, flattened strips deftly, and coiled the braid into a pot. The intestines shortened and thickened and became brittle with boiling, so that when we cut them the sections snapped and popped and sprang this way and that." A walrus was killed and the stomach, full of shelled clams, given to Sutton. "I hankered," he writes, "for those raw clams in the stomach near me. . . . When I perceived that the molluscs had not been chewed up nor digested to any great extent I tried one. It was delicious in an unexpected way. I tried another. Then I dismissed whatever inhibitions remained and downed them by the dozen. I believe my system needed them, for they seemed to satisfy an indefinite craving. . . ."

If these quotations give something of the flavor of the book, it must not be thought that all—or even most—of this adventure requires strong stomachs on the part of author and reader. There is tenderness and understanding and humor and a genuine liking for the primitive people among whom he lived. He taught them, to while away a dull evening, the old-fashioned card game of Snap! "Doubtless you have played the game," he writes, "though you may have called it by another name. It is a simple game. Childish in fact. But just try it, for one whole evening, with the Eskimos!"

"All goes well until John Ell or Kayakjuak or Kooshooak becomes really interested. One by one most of the players are weeded out as their piles of cards are exhausted. Now only a few 'good' players remain.

"Blood, figuratively speaking, is in every eye. Blood, quite literally blood, is on every hand. Finger-nails are split or broken, palms gashed or scraped, wrists jabbed, and every time 'Schnap!' is called there is a wild pulling and wrestling and pounding and yelling that sets the dogs outside to fighting.

"Wait, please, until you have played Snap! for

Dr. Edwin B. Frost (right) and Dr. Clyde Fisher at Brantwood, Williams Bay, Wisconsin, July 7, 1934.

Photograph by Te Ata



six hours at a stretch; wait until you have put iodine on the wounds and bandaged up the fingers and hands of six or eight players, before you call an evening of Snap! with the Eskimos a stupid evening. . . .” Small wonder that this ornithologist became an intimate of the Eskimos and that they judged him “the sort of man who will get what he goes after.”—WILLIAM VOGT.

An Astronomer's Life. By Edwin Brant Frost. Boston and New York: Houghton Mifflin Company. 1933.

IT would not be easy to say who is our greatest American astronomer, but certainly our best beloved is Edwin B. Frost, director emeritus of the Yerkes Observatory. In his autobiography, Doctor Frost says that everybody is kind to a blind man, but this generalization will by no means explain the high esteem and the warm affection felt for the blind astronomer by all who have come in contact with him. Doctor Frost was first a genuine, human man, and second he was an astronomer, and all his friends as well as all who read his delightful book will realize that his handicap, coming soon after middle age, calamitous though it was, had very little to do with the case.

He was born in Vermont, educated at Dartmouth from which he received his baccalaureate, master's, and an honorary doctorate degree. He pursued graduate studies in physics and astronomy at Princeton, Strassburg (Germany), and at the Royal Astrophysical Observatory at Potsdam. Of his student days he has written a fascinating account, with almost all of the astronomy left out.

From beginning to end the book contains more amusing anecdotes than any autobiography or biography I have ever read. This leads me to suspect that the author kept a note book of these stories. How else could he recall so many? His keen sense of humor is shown by the number and the fitting quality of these.

He seems always to have had the bent of an all-round naturalist, his first love being the birds. On his tenth birthday, his father and mother presented him his first bird-book, E. A. Samuel's *Birds of New England*, which is still one of his treasures. When mere boys, he and his brother adopted the call of the olive-sided fly-catcher, rather a rare bird, for their own. And many years later, at an important outdoor function, he tells how his daughter called him by the note of the white-throated sparrow,—a pre-arranged signal.

Doctor Frost observed independently that the frequency of the songs of the tree cricket was dependent upon temperature, and devised a formula to represent this relation.

Of popular interest are his investigations of the question whether the winters have not changed, becoming milder than formerly and with less snow. Forty years' records at Dartmouth and thirty years' records at Yerkes Observatory failed to indicate any noticeable change in the climate.

The experiment by means of which the lights of the Century of Progress Exposition were turned on by the light from the first magnitude star, Arcturus, caught by the world's largest refracting telescope in Doctor Frost's observatory, is a romantic conception first suggested by the blind astronomer.

The life story of Doctor Frost is surprisingly free from technical astronomy, and consequently is well adapted for the lay reader, as it should be. It is the account, however, of one of our foremost astronomers, who was for years professor of astronomy and director of the observatory at Dartmouth, from which position he was called to the University of Chicago as professor of astrophysics. From 1905 to 1931 he was director of the Yerkes Observatory, which is under the control of the University of Chicago. In 1912, in recognition of his outstanding work in the field of astrophysics, he was granted an honorary doctorate of science degree by the University of Cambridge. His host of friends and admirers will be grateful for this story of *An Astronomer's Life*.

THE BLIND ASTRONOMER

| | |
|-----------------------------|-----------------------------|
| I see him day by day, | His eager brain, |
| His clean, fine face— | His search for Truth, |
| His almost silver hair— | His finest hopes |
| Smiling as he feels his way | Are caged and blinded |
| Through awakening spring- | By the darkness of his eyes |
| time days | And yet I see him |
| He cannot hope to see. | Day by day |
| | Smiling with the spring. |

Written by his son—FREDERICK H. FROST

Ocean Waves and Kindred Geophysical Phenomena. By Vaughan Cornish. With additional Notes by Harold Jeffreys. Cambridge University Press, 1934.

IN this interesting book Doctor Cornish reveals how he became so fascinated with the waves which beat upon the south coast of England, that he was led to give up his secluded home on the cliffs near Branksome Chine and investigate various wave phenomena in different parts of the world. The greater portion of the book is devoted to a narrative account of the numerous observations and deductions that were made by Doctor Cornish on the waves which are raised by wind upon the ocean, of the kindred forms which wind and currents raise and propel in sand and snow, and of tidal bores and progressive waves in rivers. To supplement the observations made by Doctor Cornish, Doctor Jeffreys has prepared a section devoted to the mathematical and geophysical interpretation of the data gathered by Doctor Cornish. This joint account of existing wave phenomena is not only of great value to the student and geologist who is obliged to interpret the wave impressions and kindred phenomena found preserved in the rocks of past ages, but it is of interest to the layman or the scientist who frequents the seashore or sails on ships.

—CHESTER A. REEDS.

The Naturalist on the Prowl. By Frances Pitt. With photographs by the Author. New York. The Macmillan Co. 1934. Svo. 137 pp.

THIS book is an introduction to the delights of a natural history interest out of doors from the first gray of dawn till the shadows of night descend, with practical hints from the author's wide experience for observing and particularly photographing wild birds and animals. It is a colorfully written narrative of varied field experiences in Britain,—with a pair of starlings nesting in an apple tree, a dotterel in the Scottish mountains, puffins and gray seals on the coast, and so forth.

Though books and articles of similar scope dealing with American birds are not lacking, it will make a worth while addition to any nature lover's library, and the subject matter is so general as to be of interest anywhere. It would be hard to find a greater abundance of useful suggestions more pleasantly or less obtrusively presented in one small volume; or a better balanced philosophy for the amateur naturalist who goes afield sure of finding beauty and interest in the wild, with the chance of adding to the sum of human knowledge, and with respect for the value and principles of conservation.

References to many species contribute sound knowledge of their habits and place in nature. The "rustling" of bat wings is, however, something one might take exception to, even if merely a figure of

speech. The strong presumption is that British bats fly not much less silently than do ours. The illustrations, photographs, are superb. There is not a great deal of significant data about the birds and animals mentioned, but as such we may call attention to a discussion of the dancing of male black-cocks; evidence that the gray lag goose has a sense of smell; and a photograph of a puffin with a beakful of fish tells something of the feeding habits of that bird.—J. T. N.

The Great Trek. By Eric Anderson Walker. A. and C. Black, Ltd., London, 1934. 8 vo. 389 pp. 3 maps.

THE Great Trek means only one thing to the South African. It refers to that mass movement of Dutch Boers from the old Cape Colony into the new and free lands, the future states of Natal, Orange Free State, and Transvaal. Starting in 1836 and concluding in 1848, it represented a stubborn gesture of a stubborn people to maintain their way of life even if they had to trek far to seek it. The tragedy lies in the fact that they never really gained their end because that was impossible. Neither in numbers, in distance, nor in hardships was this a migration to take first rank among those odysseys famous in history. No Moses appeared to guide these wander-loving people; and no epic has as yet been created to transmute their annals into literature. And yet the Great Trek does stand out as a great gesture, a symbol (if not a portent) of South African history. It sums up the story of a people who were their own worst enemy and who monotonously repeated the errors of their fathers. But more than this, it clarifies the drama of race contact and race conflict, the end of which is still uncertain. This last will, I think, be of intense interest to ethnologists and other students of race. But for all readers this particular history of the Great Trek is to be recommended. It is vivid, intelligent, and imaginative.—H. L. SHAPIRO.

Recent American Museum Publications

NOVITATES

- No. 746. A Molluscan Faunule from the Pierre Formation in Eastern Montana. By H. N. Coryell and Eleanor S. Salmon.
No. 747. Two New Frogs from Darien. By Emmett Reid Dunn.

BULLETIN

- Volume LXVI Art. IV. The American Museum Congo Expedition Manatee and Other Recent Manatees. By Robert T. Hatt.
Volume LXVI Art. V. New and Rare Cuban and Haitian Terrestrial Isopoda. By Lee Boone.
Volume LXVI Art. VI. Studies on the Organs of Reproduction in the Nudibranchiate Mollusks, with Special Reference to *Embletonia Fuscata* Gould. By Leslie A. Chambers.
Volume LXVI Art. VII. The Pangolins and Aard-Varks Collected by The American Museum Congo Expedition. By Robert T. Hatt.
Volume LXVII Art. VII. Contributions to the Geology of Northern Mongolia. By Radcliffe H. Beekwith.

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Quoth 'THE RAVEN' (Bulletin of the Virginia Society of Ornithology) in December, 1933, concerning

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By Ludlow Griscom



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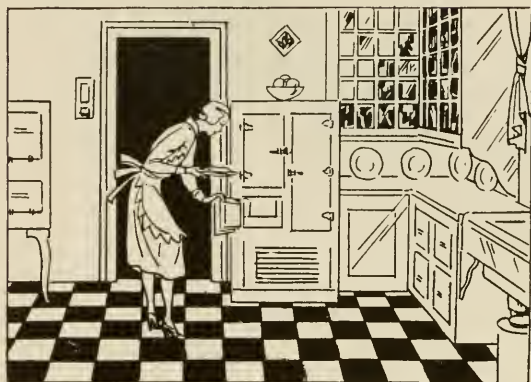
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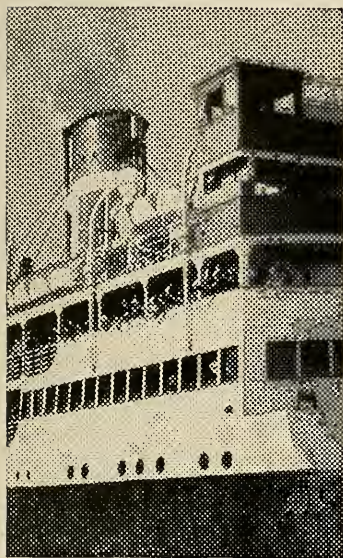
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The Journal of the American Museum of Natural History

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A Street in Bethlehem

Different in detail though the cities and villages of Palestine and Syria always have been, they nevertheless must often have been similar in general appearance and in atmosphere. From the article on Dura by Doctor Hardy, in this issue, therefore, one may be able to obtain at least a general idea of the cities of Palestine as they were shortly after the time of Christ

NATURAL HISTORY

December, 1934.

Dura—An Ancient City of the East

by
Edward Rochie Hardy, Jr.

The arid lands to the east of the Mediterranean Sea are the home of three of the great religions of the world. The Bible and the Koran were written, consequently, with these lands as a background, with the result that Christian, Jew, and Mohammedan alike draw their basic religious laws from this region. But all too rarely have these lands been described as they were during the periods at which these religions were originated, and it is in an attempt to give a picture of a typical city and its vicinity of the time of the Roman occupation, shortly after the beginning of the Christian Era, that NATURAL HISTORY presents the following somewhat imaginative description of Dura. The recently uncovered ruins of this city of the Euphrates Valley are here described as they were about 185 A.D., when it was still under the control of Rome. To a greater or a less extent all the cities of Palestine and Syria resembled, the city of Dura as it is described here by Doctor Hardy.—THE EDITORS.

AT the time of year when everyone's attention is being drawn to events that happened in Palestine and Syria, recent discoveries as to how life was lived in that part of the world eighteen centuries ago are of more than usual interest. A remarkably complete picture of the life of a town on the Syrian border is being given by the excavation begun by the French and now carried out by Yale University at Dura on the Euphrates. Here, on a site neglected, indeed unknown, until a few years ago, a whole town is being laid bare.

* * * * *

It was on a bright spring day, in the year which we would call 185, that Lucius Scribonius Mucianus first came in sight of Dura. Son of a leading family in one of the Roman towns of north Africa, he was starting out in a career in the government service. As the first step, he had received a commission as prefect in command of the *cohors II Ulpia equitata* (second Ulpian mounted infantry), and was on his way to meet his

troops. At Antioch he had reported to the governor of Syria, and had been introduced to the red tape of Roman army administration. One of the sergeants (*decurions*) of his cohort, and a few of its soldiers, were escorting him. From Antioch they had moved east to the Euphrates, and then followed the road down that river. On their right stretched the Syrian desert. Across the river were the almost equally barren lands of Mesopotamia. For some distance above Dura, however, irrigation made possible the farms, and even the orchards, of its citizens. At the moment Mucianus and his escort had turned aside from the cultivated land, as the road they followed swerved to meet the caravan route straight across the desert from Palmyra. About a mile northwest of Dura they passed through a triumphal arch. Its inscriptions proclaimed that Trajan had passed this way seventy years before on his invasion of the East. It was simple and unadorned, yet enough to remind Mucianus of the monuments of his home town, and even of the

Dura

On a site neglected until a few years ago, beside the Euphrates River on the borders of Syria, excavations begun by the French and now carried on by Yale University are bringing to light the details of an important Roman outpost of 2000 years ago. The airplane view below shows the outlines of the ruined city

Courtesy of the Gallery of Fine Arts, Yale University



Courtesy of the Gallery of Fine Arts, Yale University

The Palmyrene Gate of Dura is remarkably well preserved and shows clearly the methods of fortification used in the erection of city walls of biblical times

Below:

A model, made under the direction of Henry Pearson, of a Christian chapel excavated at Dura during the season of 1931-1932. Such chapels, neither numerous nor large, were increasing in number and importance during the period described in the accompanying article

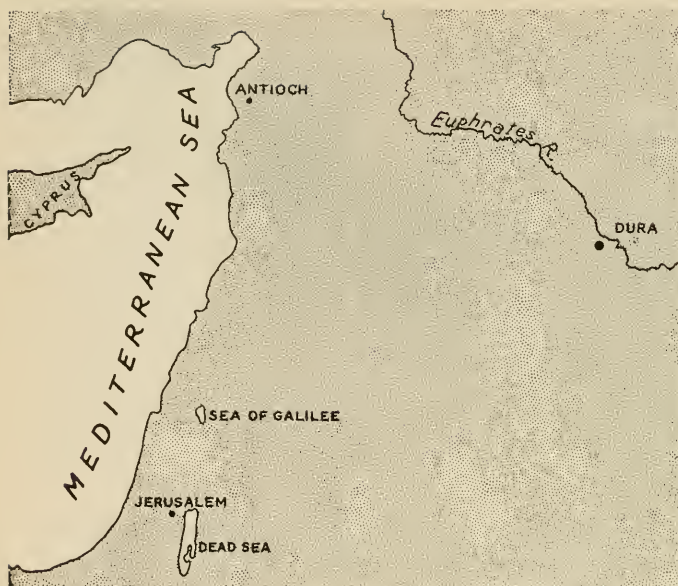
Courtesy of the Gallery of Fine Arts, Yale University



*Courtesy of the Gallery of
Fine Arts, Yale University*

Remarkably well preserved
frescoes have been found here
and there among the ruins of
Dura. The picture at the
right shows the fresco of the
Tribune as it has been copied
by Lois North. It is a scene
of sacrifice by a Roman officer
and soldiers to the Palmyrene
gods. (See page 698)





Dura, though detached from Palestine and actually on the borders of Syria, was on main routes from Antioch and Palmyra to the east, and consequently had considerable contact with the cities of Palestine

imperial city. But his moment's homesickness was soon dispelled by the eagerness of youth. Ahead of him was the wall of Dura, behind it his future home.

The desert wall of Dura ran from northeast to southwest for about a third of a mile. More than twenty feet high, it was a massive and striking fortification. Its battlemented summit was broken by several towers, and by the massive gate toward which Mucianus was now heading. The road, coming from the west, reached the Palmyra gate at an angle. The construction of the gate showed that Dura had never ceased to be primarily a fortress. Three successive doors barred the way, and on either side strong towers rose above the wall. But on this occasion all was peaceful. The doors were open, and only a few sentries and a customs inspector occupied the guard-rooms. A caravan on its way to Palmyra was slowly moving out, its camels heavily loaded with goods from the East. Mucianus' uniform and his military passport saved him formalities at the gate. He returned the salutes of the soldiers,

kissed his hand to the statue of the Fortune of Dura, which stood in a niche in the wall with a lamp burning in front of it, and so entered the city.

Ahead of Mucianus ran the principal street, which broadened to over thirty feet, and was bordered by colonnaded buildings. But the decurion turned instead to the left, down the narrow street which ran directly under the wall. On their right were the two-story houses of which most of Dura was composed,—stone in the ground floor, brick above. Except for an occasional entrance, usually a very narrow door, they presented blank walls to the street. At regular intervals the cross streets opened into the street under the wall, for Dura was laid

out in regular square blocks, much like an American city of today.

"They say this city was laid out by one of Alexander's generals," the decurion explained.

Nearing the northwest corner of the city, the little group turned into side streets and then emerged on an open space.

"The government has been planning to build us a regular headquarters ever since we came here," went on the decurion. "They've torn down some buildings for it, but that's as far as they've got in the last twenty years. Our barracks are those made-over private houses to the right,—that building in front is a temple we all use for headquarters. You'll be assigned rooms in the commander's house at the left."

Under a columned gate they entered the temple of Artemis Azzanatheona.

The temple consisted mainly of a large, rather irregular, open court. The actual shrine of the goddess and its anterooms jutted out from the wall opposite the entrance, near the left-hand corner. A few of

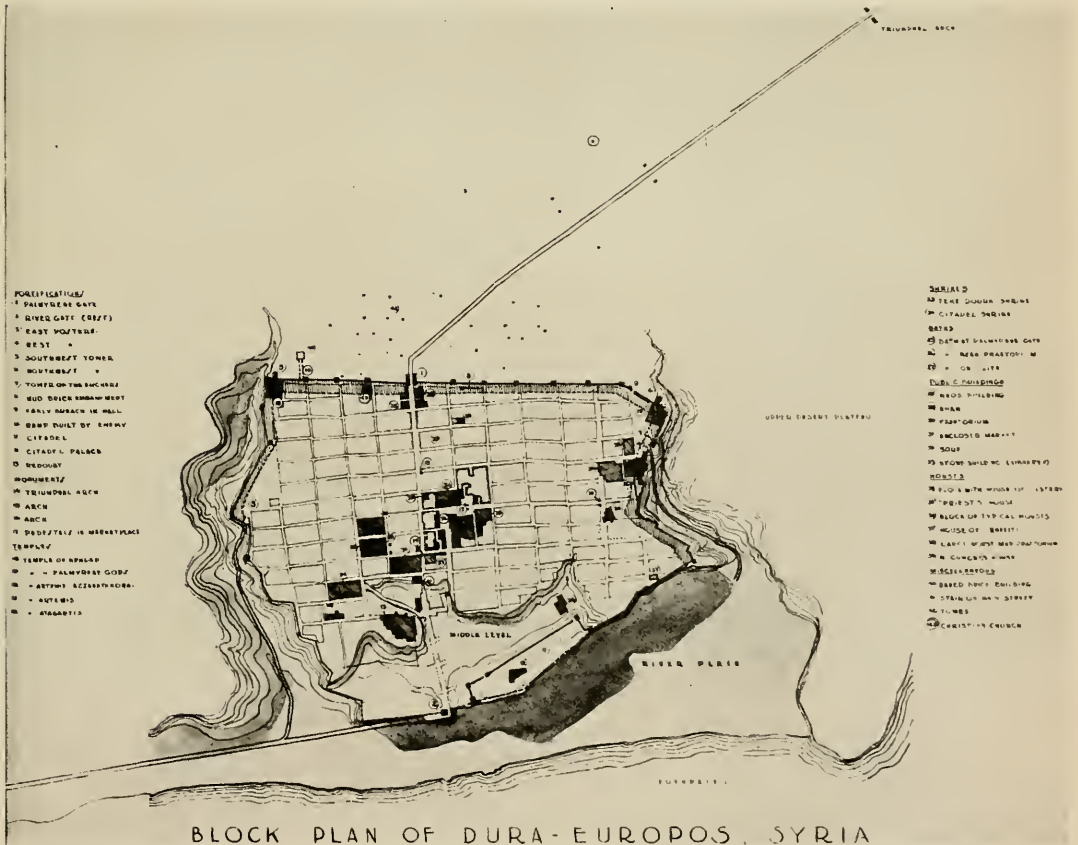
the rooms about the sides were smaller chapels, but most had been turned into the headquarters offices and record-rooms of the Ulpian cohort, and the detachment of the IV Legion (Scythian), which together made up the garrison of Dura. Mucianus was not formally to take over his command until the next day, but he found his predecessor waiting to receive him with a guard of honor, the bright colors of their parade shields shining in the sun. Soon the soldiers were dismissed to their posts, and the two Romans went into the company office.

Here the *actuarius* (company clerk), with a few assistants under him, was waiting to exhibit his files. But first Mucianus paused to look over the three letters which were waiting for him. Each was written on papyrus, folded, addressed on the outside. The first was a circular from the governor of Syria, to all commanders: "Please show all courtesies to the Parthian envoy Vologeses,

now on his way to Antioch. Give him the customary escort, entertain him at your posts, and report all expenses." The second informed Mucianus that Athenodorus, son of Nicanor, hoped that he would dine with him that night in the presence of the god Iaribol. The third told him that the legionary commander and the procurator (comptroller) of the province, were at the commander's house, and would be glad to see him at noon.

Then the retiring officer explained the records:

"Here is the list of your men, arranged in order of enlistment. Twenty years here, the cohort has been filled up with local recruits. The record of the horses gives description, price, and who approved the purchase. Awful lot of red tape in this business; everything like that has to go to Antioch. Then this is the journal,—each day your name, the watchword, record of





“Beside the
Still Waters”



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Two thousand years seem to have passed almost unnoticed across such scenes as this, for certainly the Twenty-Third Psalm was written with just such a spot as this in mind, and even the costumes shown in this present-day photograph seem to belong to the period in which the Christian religion was originated

any changes or special details. And the official calendar will tell you what imperial birthdays, and so on, we observe. What watchword would you like for tomorrow, by the way?"

"*Pax Augusta*," replied Mucianus.

At the noonday meal Mucianus met his superior, and the visiting procurator.

"Fortunately we aren't very busy just now," the legionary officer was saying. "You must detach some of your own men tomorrow to send the procurator on his way back. Better tell your decurion to give them some of the old horses; that'll make him see you need some new ones. Then, in a day or two, this Parthian will be at the frontier just below us, and we must both send some men down to meet him. There is some kind of city festival today, and we'd better both put in an appearance at the sacrifice late this afternoon. I'm asking one of my centurions to show you around the place before that. He served under Marcus Aurelius on the Danube. Are you going to old Athenodorus' dinner, by the way? You might as well; he's the chief man on the city council, even if he is rather stuffy at times."

A TOUR OF THE CITY

The centurion took charge of Mucianus after the meal. By steering the conversation away from the campaigns of the great Marcus whenever they came up, Mucianus was able to get quite a lot of information out of him. He was only too willing to talk about the map he had drawn on his dress shield, which showed all the towns he had been through on the European frontier, but most of his service had been spent in this very garrison, and he knew Dura through and through. First, being easily passed by the sentries as military, Mucianus and the centurion climbed the steps of the wall and started to walk around it.

"This place is shaped pretty much like a semicircle," explained the centurion. "In back we have the cliffs over the river, on either side ravines like this one. The desert side is the only place where the wall has nothing to help it out."

FROM A HILL TOP

They passed the Tower of the Archers, and climbed the hill until they were at the opposite side of the city from the Palmyra Gate. It was a beautiful sight. Below them the main street terminated at the River Gate, an archway from which steep steps led down to the land below. Trains of donkeys came in, loaded with foodstuffs or with jars of water. Citizens of Dura were going out to inspect their farms in the valley below. On the plain by the river the painstakingly irrigated fields and gardens pleased the eye. Beyond them the Euphrates followed its lazy course toward Parthia, and in the distance were the hills of Mesopotamia.

Mucianus and his guide descended and started west through the city.

"That is the old palace on top of the hill," explained the centurion. "The Parthian governors used to live there before we took the city. It isn't used for much now,—offices, and sometimes a reception in the state apartments. Their walls are marble, all different colors. We still keep the citadel fortifications up, though I hope we don't have to use them."

Emerging from the citadel walls, they stood on the crest of the hill overlooking the lower city. Most of its blocks were made up of private houses, lit by small courts on the inside. The large courts of the temple stood out, and the larger structures of the various baths. There was considerable movement up and down the main street, and a newly arrived caravan was filing into the courtyard of the inn near the Palmyra Gate.

The descent from the citadel was made even greater by a small ravine. It was necessary to descend below the lower city and then climb steps up to it. On the way down there was a considerable level space, where one of the junior centurions was drilling a company of legionaries.

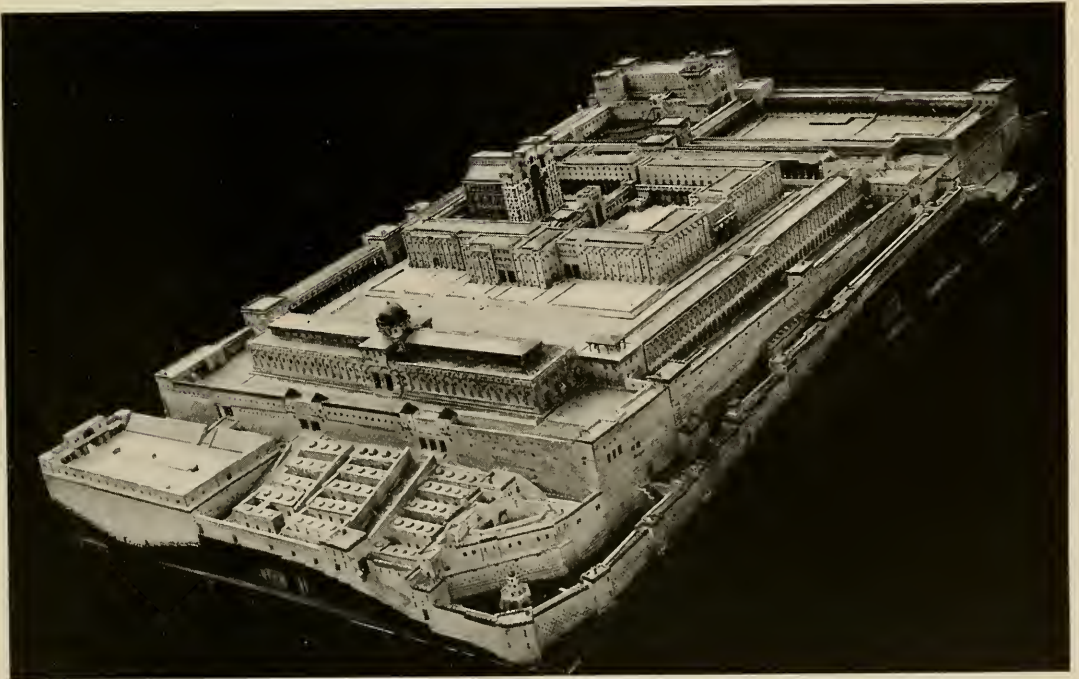
"They tore down some of the houses to make us a parade ground," the centurion explained, "but even so it isn't half way big enough."



Since time immemorial such camel caravans as this have made their way across the arid lands to the east of the Mediterranean. Though this is a present-day photograph, it is certain that such scenes were commonplace two thousand years ago

Photograph Amerian Colony, Jerusalem

A model of the temple of Jerusalem as it appeared after having been entirely rebuilt from its foundation and doubled in area by Herod, who ruled in Jerusalem from 37 B.C. to 4 B.C.



On the way up the steps the street was bordered by shops. In one a dealer was displaying to a housewife his stock of woolen goods. Some were in bright colors with designs of flowers.

"But, madame," Mucianus overheard the fellow say, "the best people are going in for quieter shades this year. Take this cream-colored one with the stripe, for instance."

In another a mother was getting new shoes for her boy who had outgrown the old ones. Well-made little leather boots, and a pair of palm-rope sandals for everyday wear.

At the top of the steps the two passed through a monumental arch, and were back on the main street, with the Palmyra Gate ahead of them. Here the street was colonnaded, and here were located some of the more exclusive shops. A men's shop displayed fine imported handkerchiefs, and the latest dalmatics (dress coats) and cloaks. In a jeweler's a young man was picking out a wedding ring. Was the inscription "*Harmony*" a good idea, or would it suggest that he was somewhat lacking in confidence? A middle-aged woman had had the whole stock of bracelets, necklaces, earrings, and pendants displayed to confuse her in selecting a birthday present. Farther on a dry-goods dealer carried the fine linens which the rich merchants' wives wore on great and sacred occasions, and a fancy pottery shop was well stocked with jugs glazed a beautiful green, delicate imported plates, and decorative lamps. Mucianus' eye was caught by the grinning head of a negro, which turned out to be a bronze jar.

MARKET SQUARE

"Do you want to take a look at the market square?" said the centurion, and when Mucianus agreed, they turned left, under another monumental archway, into one of the more important cross-streets. On either side were smaller shops, mere booths, in fact, barely big enough for the proprietor to get in with his goods. Farther on, a broader plaza led off from this street, and the main Market Square, which replaced

an entire block. Here was the final terminus of the caravan route, as far as it entered the city. In the larger stores the caravans passing through could find supplies and fittings. In the lesser streets of the business district were the stonecutters, the blacksmiths, the potters.

THE LANGUAGE

"Do you have to learn Syrian to live here?" said Mucianus as they returned toward the main street. He had noticed that the conversations and bargaining in the market were mostly in that language, and that it was in Syrian that the children had shouted at their games.

"No," replied the centurion. "Everybody of any education talks Greek, though I don't suppose there's much Latin outside the army. They have all kinds of people here, though. Most of these camel-drivers who go through are Arabs of one kind and another. Palmyrenes, Persians, people from all over Syria. The only kind I can't stand are those old families, like the fellow you're having dinner with tonight. They still call their children Alexander and Seleucus, and are stuck up about being descended from the first settlers, but, except for their names, they're as Syrian as anybody else here—as much as your wild men in the cohort."

Another digression from the main street took them to the temple of Atargatis. Like the temple in which Mucianus found his headquarters, the main feature of this was a large court, with a sanctuary and smaller shrines around. In the shrine, partly visible from the court, priests in white robes and conical mitres were conducting the afternoon ritual of changing the clothes of the goddess and her divine consort Hadad. Off one corner opened a room with seats arranged like a theater, where the council was in session. And scattered around in the court of this, the principal temple of the city, were votive stelae. One was offered by the council of Europus for the health of the emperor.

"Why Europus?" asked Mucianus.

"Oh, that's the old name of the place, given by the founder after some place in Macedonia."

A majestic slab recorded how Lysias, son of Diogenes, had built this chapel to the glory of the goddess and for the welfare of his family. Near it Abu Ilim the Arabian prayed, on a cheap plaque, for himself and his daughter. Elsewhere sightseers had scratched their names on columns. Had Mucianus been a more sensitive young man, he might have speculated on what causes had brought these worshippers who were bowing before the chapels. Grief and hope, business and love, and many other of the things that move men and women were doubtless represented. On the way out, the two passed a merchant doing business with an astrologer; his daughter was about to be betrothed, and how much would he charge for casting the prospective son-in-law's horoscope?

A JEWISH HOME

Mucianus and the centurion turned their steps back toward the commander's house. They left the main street near the gate, and followed one of the streets parallel with the wall. At the door of one of the houses the centurion stopped and knocked. It was opened by an old and dignified Jew. The centurion introduced him as the school-teacher Samuel, and asked if he would show them his buildings. The rabbi took them first into a court, such as that of most private homes in Dura.

"Here are my rooms," he remarked, "and there a hostel for poor travelers of our nation."

THE SYNAGOGUE

Another court was visited, on one side of which was a somewhat higher building. This was the synagogue, into which Samuel conducted them. It was a fairly large, oblong room, the dimly visible walls covered with frescoes of scenes, as he explained, from the sacred books. Near the center of one of the longer sides was a platform, and next to it a columned niche, similar to the inner

shrines in the temples. A curtain was drawn before it, and a burning lamp hung in front.

"That is your . . . err-r," said Mucianus, suddenly remembering that these were the curious philosophic worshippers who did not use statues.

"The Law of God," nodded Samuel, with a gentle smile.

"There are," said the centurion when they had left, "many things in this street you wouldn't guess from the fronts of the houses. There is a cave, if you know what I mean,"

"I hope to be reborn" said Mucianus, knowing that the reference was to the religion, or secret society, of Mithra to which so many soldiers belonged.

"I am a lion," said the centurion, and Mucianus bowed in recognition of his high degree. "I have been able to give a painting of Zoroaster to our chapel, which was built by one of the legionary commanders some years ago. We shall be glad to see you.

"This house we are passing belongs to a man you ought to watch, I mean your *actuarius*. It's all right for him to have part of a two-family house, like any other married man in the auxiliary forces. But when he takes the whole house, and orders a tile roof with his portrait among the designs, and says he does it by practicing as a notary public on the side, I think there's something queer about it."

Mucianus commented with a grunt which neither committed him nor stopped the flow of discourse.

"Then down at the other end of the street they say one of these houses is really one of those Christian churches. I know the government is going easy on them just now, but I think it's dangerous to have them allowed in a garrison town, and so near the frontier. I understand one of the potters in the market is their bishop, I think they call it."

It was indeed true that one of the houses was the meeting-place of the Christians of Dura. It was a small community, one of those in which the few Christian heads of families chose one man for bishop and

another to be their deacon, a type of organization common in the small Syrian churches of this period. Two rooms in the house were thrown together as the main meeting-place, and another was provided with a tank for baptisms. This latter was soon to be decorated with frescoes of the Good Shepherd, and various scenes from the New Testament. Doubtless the old centurion would have been much more alarmed had he known that the same day that brought Mucianus to the city had brought a copy of the new *Life of Christ* by Tatian, which was used for the gospel readings in the churches of Syria. Even in the camp there were soldiers as loyal to this new religion as he was to Mithra. On one of the walls in the headquarters had been scratched an anagram of the Christian liturgical formula *pater noster*.

THE CITY'S BATHS

On returning to his quarters Mucianus asked where the baths were.

"There are several in the town," he was told; "the best one is in the main street near the Palmyra Gate. But if you're in a hurry, there are good enough facilities just the other side of the barracks."

There he went, since the sacrifice and dinner were soon due. Just as an American knows he is home when he sees a drugstore, so the Roman found something familiar, all over the empire, in the baths. At Dura they were especially important, since the supply of water was so hard to get that there were none in private houses. Even in the second-best bath of this frontier town, Mucianus found dignified halls and the hot and cold pools he had been used to at home.

INCENSE AND SACRIFICE

So refreshed, Mucianus donned his white holiday uniform, and went with several of his cohort to the temple of the Palmyrene Gods. Here a crowd was gathered in the court. Many of the soldiers were here, and many of the citizens. Travelers from Palmyra who had just completed the five-day journey across the desert were glad to

find that the festival was being observed. The local aristocrats in white tunics, their wives in white robes and an abundance of jewelry, took their places on the steps of an outer shrine. The legionary officer and Mucianus were ushered to positions befitting their dignity. Holy water was sprinkled over the crowd with a palm branch. Incense was offered on the burners that stood before the shrines. White-robed priests opened the inner shrine, revealing the statues of Baalshamin, Iaribol, and Aglibol. Mucianus noted with a smile that they wore the general's uniform of Roman emperors, with its cuirass and kilt. What was it that that philosopher had said in his student days at Rome? "All human thoughts of any god were but sacred statues, behind which the one and manifold divinity could be worshipped." That, it seemed to Mucianus, was a sensible outlook on religion. To the sound of cymbals and accompanied by dances the victims were brought out and the sacrifice offered.

While a sacred dance continued at the temple, the Romans seized the first occasion to slip away. Changing into evening dalmatics for Athenodorus' dinner, the commander and Mucianus repaired together to his house. This was one of the few large houses left in the center of town, where most of the old families had changed their houses into accommodations for several families, or had built shops around. Slaves helped the visitors to wash their feet and hands, and brought them into the main room where the company was gathered. The walls of Athenodorus' house were covered with frescoes from classical mythology. Its ceilings were made up of tiles stamped in decorative designs, flowers mostly, with a few portraits among them. But the general plan was the same as that of almost every other house in Dura. Blank to the street, its main rooms opened to the plain central court, from which an exterior stairway led to the second floor and the roof. Several others of the leading men of Dura were present to welcome the new officer. They



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Jerusalem

The minaret in the foreground is said to be built on the site of the Tower of Antonia to which Paul, the Apostle, was brought by the Roman soldiers, who saved him from the mob. During the reign of Herod, Jerusalem was very largely rebuilt, for the king, friendly as he was to the power of Rome, was attempting to do for his capital what Augustus had done for Rome. Since his time, of course, the city has been so largely rebuilt as radically to change its appearance. Nevertheless, it is probable that its atmosphere remains similar



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Acre as seen from the water. This ancient city on the seacoast of Palestine has played an important part in the history of the eastern Mediterranean since before the time of the Phœnicians. The walls shown in this photograph date from the time of the Crusaders



On the shores of the Sea of Galilee. This photograph was taken at Tiberias which lies somewhat to the north of the old city of that name. The original city was founded about 21 A.D. by Herod Antipas, and named after the Roman Emperor, Tiberius. A more ancient town, probably Rakkath, had occupied the site at an earlier time

*Copyright E. M. Newman,
Publishers Photo Service*

were dressed as gentlemen would have been anywhere, in tunics and formal cloaks of various cuts. The women wore the high Syrian headdress which was becoming fashionable in the West at this time. If Mucianus was a man of taste, he thought they wore too much jewelry.

ATHENODORUS' DINNER

With a few grains of incense to Iaribol, Athenodorus' special patron, the meal began. A toast "Long live Murianus" had been tastefully written on the wall which met the eye of the guest of honor. Several kinds of meat, with greens, special Syrian sweets, and good imported wine were served. But Mucianus was rather bored, as guests of honor often are, at talking politics with Athenodorus.

Such was life in one of the towns in which the new Christian influence was just beginning to make itself felt about a century after the death of the founder of that religion. Dura was, as a garrison town, somewhat exceptional. But in the main its affairs were similar to those of the towns in Galilee in which Jesus had lived in the century before. Pious centurions worshipped the gods of the land they lived in. Officers sat in the gate at the receipt of customs. Children played in market places. Camels moved lumberingly through city gates, and never through needles' eyes. On one side was the desert where even spirits could find no rest—on the other the green land and its flowers. Merchants planned to increase their capital, and sowers went forth hopefully to sow. And within the city walls were human hearts and souls and human love and hate.

Had my imaginary Mucianus, whose ex-

istence I have almost come to believe in as I have written this article, been a genius in insight, he might have realized the great human cry that went up from the life of Dura for something dear and lasting. Rich and poor alike knew that they would rest in time in the monumental tombs on the road to the triumphal arch, or in cheaper graves in the ravines beside the city. The rich erected their shrines in temples, or contributed stones to the sacred stairs of their ante-chapels. Poorer citizens inscribed their names on votive plaques with the petition "May he be remembered." The Arab Sai, of the Bani Bigan tribe, scratched on a wall that he passed through with a company, "and he longed for Taht and Gilbat," villages near Damascus. With equal earnestness, and perhaps more confidence, someone wrote on the walls of the church "Remember before Christ the humble Siseos."

But there is no reason to believe that Mucianus was anything but a normal young man. At the end of the evening he returned from Athenodorus' dinner, thinking, perhaps, of a girl in Carthage, gave thanks to whichever of the immortal gods he most believed in, and went to bed.

* * * * *

Note: The above fantasy is mainly based on F. Cumont, *Fouilles de Dura-Europos*, Paris, 1926, and P. V. C. Baur and M. I. Rostovtzeff, *Excavations at Dura-Europos*, reports of first to fifth seasons, New Haven, 1928-1934. My thanks are due to Professor Rostovtzeff and others at Yale for showing me the collections and material unpublished or in course of publication. They are not, of course, responsible for my imagination or for any of my possible mistakes.

The Haunts of the Wailing Bird

by
Alfred M. Bailey

Director,
The Chicago Academy of Sciences

Photographs by the Author and F. R. Dickinson

PONCE DE LEON, struggling across the pine barrens and boggy marshes of Florida, must have felt that his search for the Fountain of Youth was rewarded with success when he finally reached the source of the Wakulla River—if he ever did. Crystal waters pour from an underground spring and form an azure blue bowl, lined with cypress, myrtle, and bay, and then wend their way southward, inevitably, toward the Gulf of Mexico, between moss-covered trees centuries old. Early summer, with its myriad of bright-colored insects mirrored in the unruffled surface of the pool, is nesting time for the multitude of marsh and woodland birds dwelling about Wakulla Spring. Parula and prothonotary warblers sing in subdued tones as they attend their household affairs; herons stalk along the muddy shores, pausing occasionally to spear an unfortunate minnow; and rows of black vultures, dressed in funereal garb, sit silhouetted against the light blue of the southern sky. It is a scene typical of Florida's meandering waterways. An American egret rises from the shore, its immaculate wings glistening with flashes of light as it flies away against the sun. Suddenly the stillness is broken by a strange, strident note near at hand, a piercing "cur-ce-aw," oft repeated; a cry which rises to a height and then ends in a prolonged wail. We are at our journey's end. We may not have reached the Fountain of Youth, but we have arrived at the home of the limpkin (*Aramus*

Hunting with a camera for the limpkin, an unusually interesting bird that has come to be rare

p. pictus), a strange marsh bird which was once numerous, but which is now rare.

It was this past spring that Herbert L. Stoddard, F. R. Dickinson, and I imposed upon the hospitality of Mr. Christy, who owns this beautiful spring. He kindly lent us a rowboat so that we might prowls among the many channels which cut off vine-entwined islands, and search out the haunts of the limpkin and pry into its personal affairs. We wished to make motion films for the Chicago Academy of Sciences and we had no difficulty in locating birds and their nests. Mr. Christy has jealously guarded his bird friends, and for some years they have been allowed to attend to their housekeeping unmolested. They were numerous, and they had no hesitancy in making themselves known. From the deep shadows, back from the marshy river edge, we heard the strange, far-reaching, rasping cries, and, as we passed along, a large bird would occasionally rise from the grassy cover and fly away, with long neck outstretched and extended legs dangling awkwardly beneath. Some were perching in vine-covered trees and would fly away, protesting, as we approached; others stalked out on exposed limbs and scolded us as we paddled slowly along. On points of little islets we found piles of shells of the giant snail, where the limpkin had carried them, and near abandoned nests of the limpkin were other accumulations, indicating possibly that the one not on duty might have carried food to the incubating bird. There was an abundant food supply, for thousands of these great snails were seen clinging to cypress trees and logs, just above water, where they were depositing their clusters of pearl-like eggs.

Limpkin



The Wailing Bird

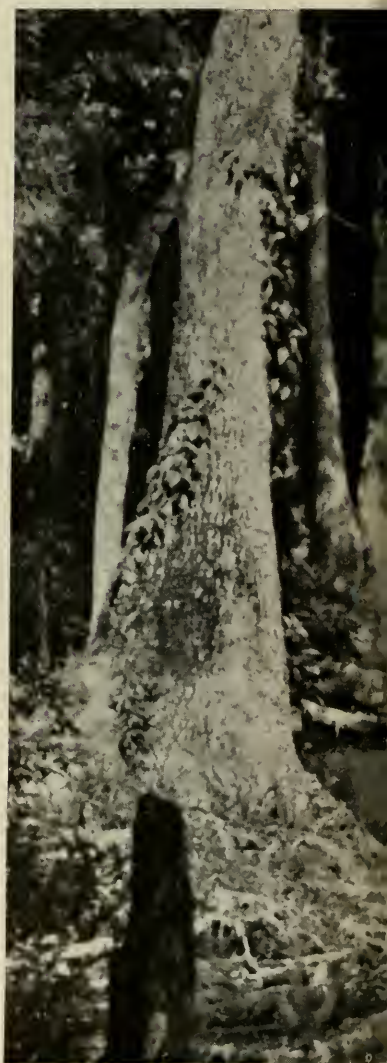
Formerly common, the limpkin has now come to be a comparatively rare bird. The photographs illustrating this article were taken by Mr. Bailey and Mr. Dickinson with a motion picture camera from a blind on a private bird reserve in Florida



From a blind set up within a few feet of the nest, the photographers made these pictures. Undisturbed though these birds normally were, the one whose nest had been chosen showed more than a little timidity when in the presence of the blind

At Wakulla Spring

It was in the neighborhood of this large Florida spring that the accompanying photographs were made. Because the owner of the property has protected the feathered inhabitants of the region during a period of years, limpkins are fairly common in the neighborhood, though they proved reluctant to pose for the photographers





A large alligator snapping turtle tumbling down the muddy slope of one little island attracted our attention by its awkward efforts to reach water. We paddled shoreward and there was a flutter of great wings as a black vulture floundered from the dense thicket at the base of massive cypress trees, raised into the air, and then alighted a few yards away among masses of Spanish moss. An old cottonmouth water moccasin slid from his dank resting place amidst the thick growth of spider lilies into the depths and disappeared among the twisting roots. A short distance beyond, upon the ground at the foot of the palmettoes and cypresses, were two of the homeliest bird youngsters we had ever seen. Apparently our good looks were not appreciated, for the young vultures became violently ill, and we realized that their last meal had consisted of food a long time dead.

EMPTY NESTS

Three-quarters-grown young limpkins running through tangles of *Sagittaria* warned us that we were too late in the season to secure photographs of nesting birds, unless we were fortunate, for empty nests which had been used but a short time before were found on almost every island. Adults continually scolded while we remained near the abandoned nests; probably their young were crouching in cover near by, but we found no occupied nests until we had nearly exhausted the possibilities. And then, along the shore of the river, we saw one in the open, surrounded with a growth of green trailing vines and masses of flowering wild roses. As we watched, a long-legged bird raised from the nest, stood for a moment, and then launched itself awkwardly over the side and disappeared, protesting querulously. Three eggs were in the firmly anchored platform, and the location was ideal for photography. The masses of green foliage which framed the limpkin's house proved to be poison ivy, but a photographer does not mind such things. The blind was erected on a convenient stump, and it was my privilege from

this observation spot to indicate to my companions which of the poison ivy vines would have to be eliminated so that a clear view of the nest might be obtained. Then, when all was in readiness, we left so that the old one might become accustomed to the canvas hiding place.

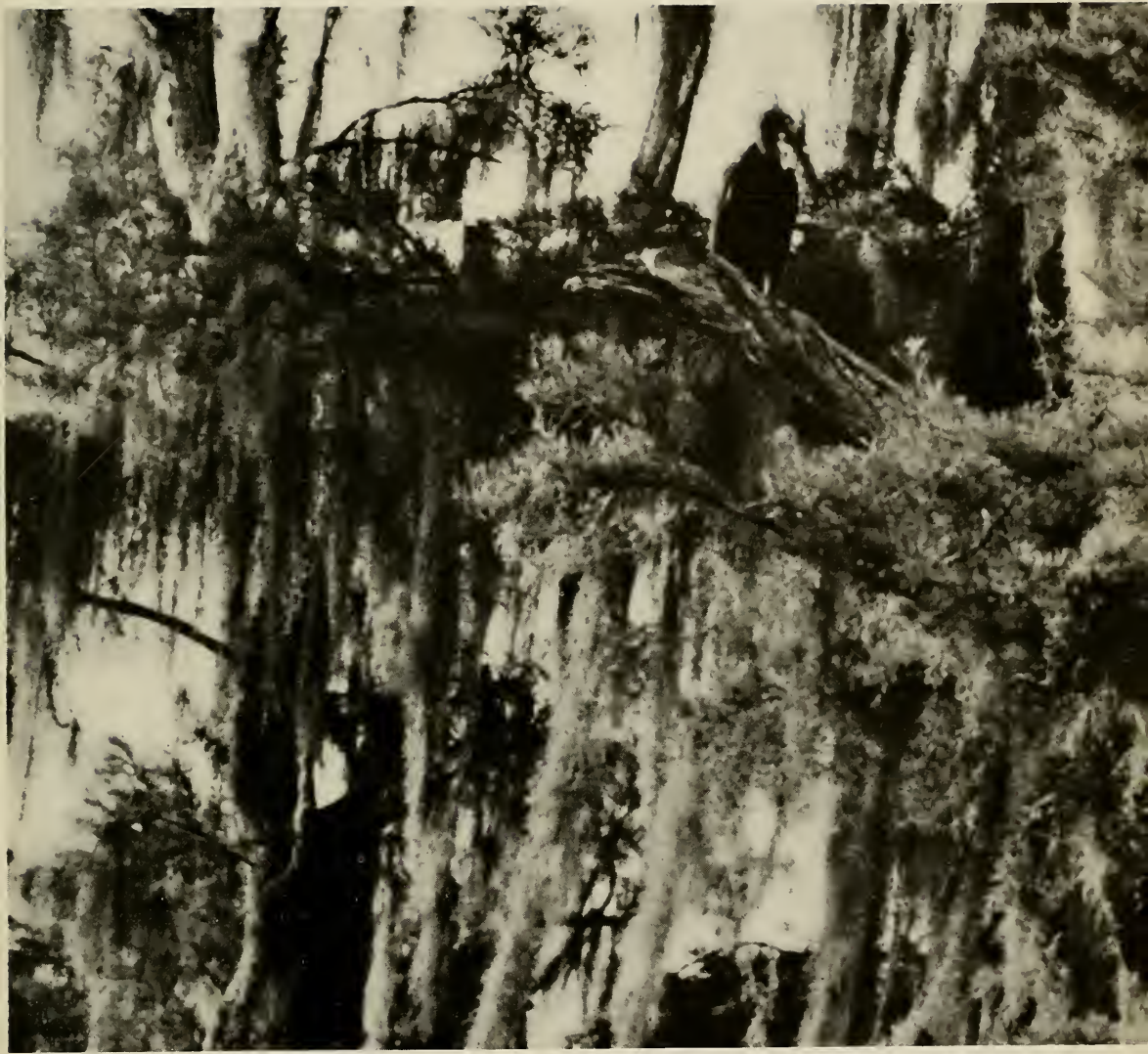
As we paddled off, weaving our way carefully through a tangle of fallen and half-submerged cypresses, one of the wailers followed us for a short distance, keeping well hidden behind the trailing vines but complaining ceaselessly with its strident calls.

It was a day later, after the sun had climbed high enough to drive away the shadows, that we returned to the nesting site. Swallow-tailed butterflies hovered over flowering marsh plants, and the eerie cries of a pair of ospreys nesting on a nearby cypress snag blended with those of the wailing birds in protesting our arrival. I climbed into the blind; the camera was in place with the lens focused upon the three eggs, and all was in readiness for the arrival of our victim. My companions pushed off from the shore and soon the squeak of the oarlocks died away in the distance. The shrill screams of the ospreys were modulated to routine family discussions and the wailers ceased their scolding. Then, a short distance away, a long-legged bird with light spotting stalked from behind a clump of gray Spanish moss upon the bare limb of a dead cypress; it eyed the blind for a few moments, the brown eyes scanning my hiding place carefully. Satisfied, apparently, that all was well, the wings opened and the bird launched heavily into space, dropping behind a tangle of vines a short distance from the nesting platform.

THE SUBJECT APPEARS

It was just nine o'clock in the morning; light conditions were ideal and now was the time to secure our pictures. We had traveled eight hundred miles by car; had imposed upon the good nature of our friends in helping us locate the haunts of this strange wader; and in a few moments more I could

Sentinels



Black Vultures

In the neighborhood of Wakulla Spring, black vultures were commonly seen sitting on moss-draped branches, and a pair of unattractive young were found on the ground among the palmettoes and cypresses





Spider Lilies

These beautiful lilies, conspicuous among the rank vegetation that surrounded the spring, made a gay note amid dark cypresses and Spanish moss. Masses of poison ivy and wild roses also formed colorful patches against the deep undergrowth





Warbler

Above: Parula and prothonotary warblers sang among the foliage which was reflected in the azure blue waters of the spring. The photograph shows a prothonotary warbler at the entrance to its nest

Below: Giant snails clinging to the cypress trees and logs just above the water



Giant Snails

A favorite food of the limpkin is the giant snail, and piles of shells of these creatures are found near the abandoned nests of the limpkin. The pearl-like eggs of the snail are often to be seen where they have been deposited on the bark of trees and logs near the water

start cranking the camera. There was a rustle of vegetation, the long, brownish beak was thrust into the open, and beady brown eyes scanned the front of the blind. The limpkin was within a few feet of the nest, directly within the field of the camera, but nearly hidden except for the eyes which peered from the shadows. The sun beat down upon the blind, making a steam oven of the place, and I crouched motionless, my hand upon the crank, waiting for the limpkin to climb upon the nest. I scarcely dared breathe for fear of frightening her; perspiration dripped from my face upon the camera and ran down my arms, thence dropping methodically upon the base of the stump on which I was perched. Still the bird watched, barely moving her head. At ten o'clock she was still standing motionless, apparently without a worldly care. The eggs were protected from the sun by a trailing bit of vine, so there was no danger of their being spoiled by the heat, but after two more hours of waiting on my uncomfortable perch, three hours of standing motionless, and a noonday sun directly overhead, I was not so sure about the photographer.

THE SUBJECT DISAPPEARS

The harsh voice of the other limpkin from a near-by tangle seemed to arouse my subject to action, for she slowly came out on the swaying branch, ready to climb upon the nesting platform. As soon as she was in full view, I started to crank the camera. The bird paused with head thrown up, and with a squawk launched into the air. For three hours I had awaited my opportunity, and the bird had flushed at the first whirring of the film!

I stayed for half an hour longer without seeing or hearing the wailer, so abandoned the blind in favor of the mosquitoes which were so numerous that standing room was at a premium, and as I retreated along the shore, the bird gave no sign of being in the vicinity.

THE SUBJECT POSES

When the sun was low over the tops of the cypresses, we again rowed to the blind. As we approached, the limpkin raised from her eggs and stood watching us without showing alarm until we were within thirty feet, and then she flew from view. In the blind once more, I waited without hope, and once more heard the sound of the oarlocks dying away. There was a coolness in the air; the leaves stirred faintly in the breeze; and the dull monotone of the mosquitoes did not seem so ominous as during the heat of the day. The time for photography was short, for the sun would soon be below the fringe of cypresses and the dusk of evening would be over land and water. There was a swish of wings and a sound of a heavy body alighting on a bough, and just back of the nest was our limpkin teetering on the swaying branch, with wings half spread to aid in keeping her balance. She uttered no sound and seemed not to have the least interest in the blind or the whirring camera, for she turned toward the nest, stood for a moment as though uncertain, her long neck outstretched, and then climbed slowly upon it.

Our work was over. We had invaded the haunts of the wailing bird, had learned something of its habits, and finally, when evening shadows were long, had secured the photographs we had so desired.

An Unfinished Book

By Clark Wissler

Curator-in-Chief
Department of Anthropology
American Museum

This picture shows the hole in the cover made by a bullet. The ball passed at an angle almost completely through the book



ON exhibit in the Plains Indian Hall of the American Museum are two books of Indian drawings. The Indian artists purchased ordinary account books about $12'' \times 5\frac{1}{2}''$ such as were used by Indian traders in the 70's, and a few colored crayons, and so equipped, set themselves the pleasing task of filling the pages with drawings of men, horses, buffalo, etc. Similar books are found in other museums. It seems to have been the style for Indians of that period to fill such a book with pictures representing their own exploits in war and the chase as well as those participated in by their fellow tribesmen. The book herein described is of special interest because of the tragedy associated with it. Pasted to the cover of the book is a letter which runs as follows:

POST OF SAN ANTONIO, TEXAS. Sept. 21, 1889.
MY DEAR JOE:

Only the canvas covered book has any special history, the book with the bullet hole in it. It was, or rather the pictures were, drawn by a Northern Cheyenne Indian while in confinement at Fort Robinson, Nebraska during the winter of '78-'79.

I was then Post Adjutant. I endeavored to get the book but its owner and maker refused to part with it for any price. So I gave the matter up. It purports to depict the deeds of several of the Northern Cheyennes during their famous march from the Indian territory to Wyoming territory. The outbreak of the Cheyennes is well known, and [as] a consequence of the outbreak, I got the book in this manner. Four troops of the 3rd cavalry, "A", "E", "F", and "H" commanded by Captain Wessells, who by the way was severely wounded, surrounded the hostiles and charged upon them, killing all the bucks and unfortunately in the mêlée, some women and children; but previous to the charge I saw an Indian with the book pressed down between his naked skin and a strap around his waist; another strap went between the middle of the book and around his shoulder. I turned to Private Laselle of H troop who was near me and said, "I want that book if we come out all right." Several others of the enlisted men heard me also. When the fight was over, and as the dead Indians were being pulled out of the rifle pit, they drew out finally my Indian with the book, apparently dead; the book was injured to the extent of a carbine ball through it and was more or less covered with fresh blood. This fight took place near Bluff Station, Wyoming Territory, January 22, 1879. The Herald of the 23rd, 24th, or 25th will give an

account of the same. The muster rolls of the Troop "H" 3 cavalry on file at the Adjutant General's office will tell you of the fight also. This fight was the closing one of a series of fights with the Indians, and they perished to a man. In haste, FRANK

The engagement referred to in this letter is described in George Bird Grinnell's, *The Fighting Cheyennes*, according to information from Indian participants.

Aside from its human interest, this book of drawings is a typical illustration of the peculiar conventional style of art developed by Plains Indians. A careful study of this art has been made by Helen H. Blish of Detroit, Michigan. Miss Blish was fortunate enough to secure what is probably the finest example of these illustrated books, made by a Dakota-Sioux artist, representing events between 1870-1900. In all cases the drawings are in color, the figures first outlined with lead pencil, and then colored in with crayon. The book shown here has

about 150 leaves of which about 40 are blank, the others bearing drawings, in many cases upon both sides of the leaf. Most of the illustrations depict incidents of the warpath, about equally divided between fights with Indians, United States soldiers, and horse stealing. While all these drawings are conventional, many are spirited. One particularly impressive sketch shows the capture of a lively mule. Doubtless, had the Indian artist survived this, his last fight, the remainder of the book would have been filled with exploits of himself and companions.

While this exhibit is unusual, most objects in our Indian halls have their human side; all were made with care, and perhaps at great sacrifice, to be prized for a time, only at last to find their way into a museum. Unfortunately, details such as these are usually lacking from the record—many no doubt are associated with tragedies as interesting as this book of drawings.



A SAMPLE PAGE OF THE BOOK OF INDIAN DRAWINGS REPRESENTING A FIGHT BETWEEN SOLDIERS AND INDIANS.
AN INDIAN IN WAR DRESS, PROBABLY THE OWNER OF THE BOOK, IS PURSUING AN ARMY OFFICER

Lake Titicaca

An archaeologist explores the high lake which lies between Peru and Bolivia

By Wendell C. Bennett

Assistant Curator in Anthropology
American Museum

Photographs by Junius Bird

THERE are many ways of traveling on Lake Titicaca. Two steamboats, the "Inca" and the "Ollantu," glide silently down its length from Puno, Peru, to Huaqui, Bolivia, while the passengers sleep. It is well that they are not aware that, to the south, two peninsulas jut out to form the narrow straits of Tiquina through which the boat must pass, leaving the great open lake and entering the southern pocket known as the "Laguna de Uinamarca." This Bolivian section of the lake is dotted with islands and finger points of land around which the ship must weave, in the night, without the aid of piloting lights or buoys, and trusting solely to navigation.

In addition to steamboats small motor launches and some outboard motor speeders cruise about the lake and are operated principally by the Bolivian government to run down smugglers. These are not the best means of transportation for the archaeologist or explorer, because the lake, around many of the interesting bays and small islands, is so filled with weeds that a motor boat cannot navigate. So the archaeologist is limited in his choice to sailing vessels.

The wooden sailboats, constructed like enlarged, open rowboats with a sail in the middle, are very efficient, if there is wind and no rain. These boats are both built and operated by the Indians who run a passenger and freight service where and when business demands. Finally, there are the balsa canoes built of bundles of totora lake reed, and propelled with a long poling stick, a double paddle or a reed sail. These are the oldest type of transportation and still the most popular with the natives. The balsas are made for from one to six passengers, each type with a native name. The Indian considers the balsa the most desirable method of transportation. With wind, the sail carries his boat at a moderate but consistent rate;

without wind, he paddles; in shallow water, he poles. Weeds and lake reeds are no bar to his progress. His boat always arrives, which is more than can be said of the other types.

Lake Titicaca lies partly in Peru, partly in Bolivia, on the high plateau of the Andes, 12,000 feet above sea level. It is 95 miles in length and 35 in width, with an irregular coast line of peninsulas and bays and with many small islands. To reach the lake one takes a train from the southern Peruvian port of Mollendo and rides for two days into the mountains. In the shallow parts of the lake the water is filled with weeds and the tall totora reeds. Trees will grow in sheltered spots around the lake, if they are carefully protected, but, aside from the plantation house surroundings, the shores of the lake support very little vegetation. Nevertheless, the land in the valleys and on the lake flats is excellent for agriculture, and the territory has been occupied for centuries first by Indian and then by Spanish civilizations.

Eight to ten miles south of the lake in Bolivia are the famous ruins of Tiahuanaco. The temples, buildings, and fortresses that compose this site are more than just another ruin. Tiahuanaco is the center of a pre-Incan civilization that spread its influence and perhaps its political control to the coast of Peru, northward into Ecuador, southward into Chile and eastward into the Argentine and parts of the upper Amazon region. Tiahuanaco style, in designs, pottery making, textiles or building, is distinguished from the coast culture of Peru, and from the Inca style. Tiahuanaco history is generally considered to cover the centuries from 200 to 900 A. D. This includes a great period of



Lake Titicaca



Backed by the snow-covered Andes, half hidden in clouds, the barren shores of the lake present scenes typified by their cold beauty. The Indian lives in his adobe, thatched-roof room (see left), protected by the presence of his mountain gods. The lake is the Indian's habitat whether he sails in the modern wooden boat (see right) or in his balsa



Pub. Photo Service
Above: The balsa canoe made of bundles of totora reed is the oldest type of lake transportation



Right: With hand nets the Indians still fish as their fathers did before the coming of the Spaniards



florescence up to about 600 A. D., commonly called the Classic period, and a later period of decline (although the culture was still active) known as the Decadent period, which fills out the period to 900 A. D. When the Incas invaded highland Bolivia in the Eleventh Century, they found the temples of Tiahuanaco in ruins.

In both major highland civilizations, Tiahuanaco and Inca, Lake Titicaca has played an important part. The Incas claimed the Island of the Sun as the mythical place of their origin. Consequently the lake region, around the shores and on the islands, provides valuable archaeological material for the study of the various phases of Tiahuanaco and Inca culture. From December, 1933, to August, 1934, the American Museum of Natural History sent Mr. Junius Bird (assistant field archaeologist) and myself to Bolivia with the principal aim of exploring and excavating around the southern shores and on the southern islands of Lake Titicaca. This trip continued the archaeological investigation begun in 1932 around the eastern shore of the lake, and at Tiahuanaco itself.

A LAKE JOURNEY

Mr. Bird and I first went to Hauqui and hired a sailboat to take us directly to the Island of Pariti, about a five-hour run with a fair wind. We started at ten in the morning with fifteen Indians who were bound as passengers for points beyond. The wind blew sharply for an hour and then disappeared. Two Indian sailors tried vainly to propel our boat with two tremendous oars, but the speed attained was not startling. At five in the afternoon we landed for a short rest on the peninsula of Taraco which projects into the lake like a long finger. At night came the wind, but unfortunately, too much of a blow, because it only succeeded in frightening sailors and passengers into confusion and wails, which may have been attempts at prayers. The rain poured down. We thanked America for inventing waterproof sleeping bags. At seven the next morning our captain landed us on an island

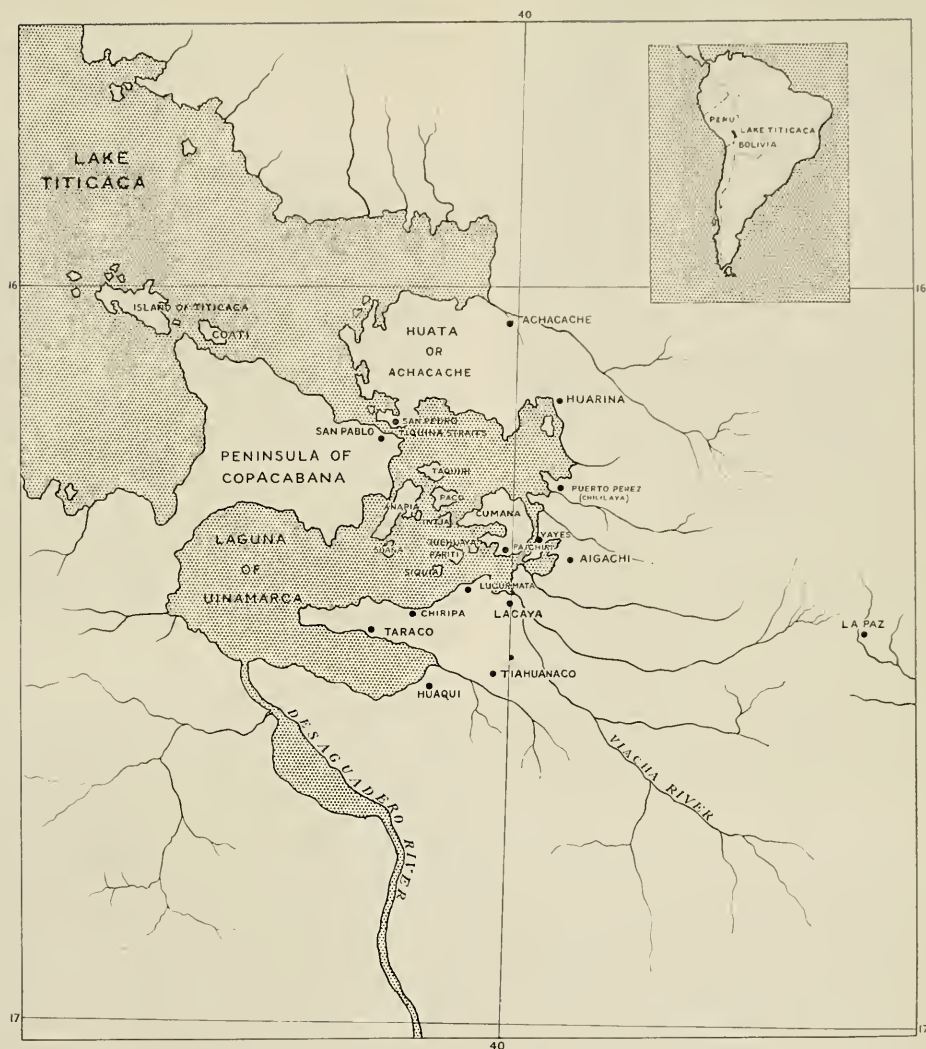
which he claimed was Pariti. When we finally found a native, he told us that we had passed Pariti long before and were now on the island of Paco. So we hired another sailboat and finally arrived at Pariti, just twenty-five hours after starting. There we were met by Sr. Pablo Pacheco who furnished us with convincing proof of Bolivian hospitality.

Sr. Pacheco's hacienda occupies the whole island of Pariti. It is a small island but contains, nevertheless, a good portion of farmland. It is surrounded by totora reed from which the Indians make their balsa canoes. Ducks and fish are plentiful. The Indians live in their thatched roof houses, grow potatoes, quinoa, wheat and barley, and herd sheep and cattle. Pariti proved an excellent center for excursions around the lake. Small islands lay in every direction and the shore was not far distant. With Sr. Pacheco's sailboat and motor launch, which he generously placed at our disposal, we visited many localities.

On the island of Quehuaya, but a short half hour sail from Pariti, we examined the ruins of an Inca village which extended around the shores of a bay. The houses are built of well-laid rough stone, with low doorways, inset niches on the interior, and corbeled arch stone roofs. Square stone burial towers are interspersed among the house groups. In total we estimated about 200 houses and 25 towers in the village. All are of typical Inca style of the same kind found around the southeastern edge of the lake.

On the island of Cumana, at a point close to the mainland, the Incas had built a bridge or road as a connecting link. The road has always been so serviceable that even today it is kept in repair. The construction is of rough stone piled up to form a pathway now about ten feet wide and well above the water when the lake is at its normal level. The water is said to be over ten feet deep at the center of the path. The roadway curves back and forth to reach the mainland, some 1000 feet away.

Farther west, on the same island of



Titicaca

A map of the southern half of Lake Titicaca (after Raimondi, Mapa del Peru, foja 30) locating the islands and sites mentioned in this article

Cumana, at a site called Pajehiri we found the first important ruin of Tiahuanaco type. We had been informed of the existence of this temple by Dr. Fritz Kuebler, director of the German College of La Paz. The island of Cumana is quarter-moon-shaped and quite extensive. Today it contains seven farms, each with an Indian name. The location of the ruin is at the head of a small but fertile valley. A path of apparent Inca construction runs by the ruin to the land-connecting bridge described above. To the west the trail continues around the island

to another artificial pathway which connects the islands of Cumana and Quehuaya. The ruin overlooks a bay from which balsas depart in all directions. This command of water and land routes made the location an ideal place for a temple.

The temple is of an open, stone-faced terrace construction without enclosing walls. It is badly destroyed but enough exists to give a rough picture. Seven upright dressed and niched lava pillars mark the remains of part of the west terrace. Small cut stones once filled the gaps between the uprights



An Indian girl watches the excavators but not without proper precautions for her pet lamb

The Indians

The bridge connecting the island of Cumana with the mainland is still kept in repair and serves, among other things, as an excellent fishing ground



Sunday market day is an important affair not only for buying and selling goods but also for gathering and spreading news. The sweetest toned flute and the brightest blankets must be used at the market. The colored blankets are woven by hand on a loom like that shown below



of Today

Where stone is available it is preferred to adobe for building permanent houses. It is a wealthy Indian who maintains a home of three separate rooms



A costume dance is indeed a fiesta, with wine and music. No dance would be complete without a clown



To the north of this terrace, and set in slightly, are three steps leading up to a platform slab. All of this unit is of red sandstone, well cut and finished. Considerable evidence suggested that at one time there were two more steps, but at present steps and top platform have been tilted out of position by treasure seekers. It is also possible, judging by the extension of the flattened land, that there was another stone-faced terrace to the north of the steps, corresponding to the one to the south. However, any reconstruction of the original plan of this temple is made difficult by the destruction resulting both from wash and the actual removal of stone. For example, most of the Inca house ruins in the valley have doorways made of two cut stone blocks taken from this temple, thus proving that the vandalism started in pre-Spanish times, and also implying that the temple is older than the houses. Furthermore, back of the terraces and the steps are irregular rows of cut stones and down the valley are many isolated cut stone pillars, all of which were removed at one time from the temple.

DISAPPOINTING EXCAVATIONS

In spite of the promising aspect of this site twenty-two pits were dug around the ruin without material results. Many Inca fragments were found, but practically nothing of Tiahuanaco type. However, the cutting of the stones, the jointing niches, and the general plan of the temple are undoubtedly of the same style as the great temples of Tiahuanaco.

Pajchiri temple, augmented with excavations on several islands, furnished us with excellent evidence of the inhabitation of the islands in pre-Spanish periods, and so we left them for a trip to Lake Titicaca's shores. We went first to the straits of Tiquina, that narrow passage which divides the lake in two unequal parts. Tiquina, on a Sunday, is a colorful place because it is the central market for the Indians of all parts of the lake. All boats passing through the straits must stop to show their proper papers. The

passage is filled with boats of all description and the little town is alive with the brightly-colored costumes of the Indians. Those there to sell have their wares spread before them on a blanket. Those buying mill about, selecting and bargaining. They have a wide choice of sellers, but a rather limited variety of goods is offered.

CHOCUPERCAS

We found no ruins right at Tiquina, but following back along the southern shore of the peninsula of Copacabana is a notable ruin. We were told that this was the ruin of Chocupercas in the section of Oje (which Doctor Uhle described as "Llojepaya" ruin). It consists of a raised terrace platform about 6 feet high, right on the shore of Lake Titicaca, and at present partly covered by the lake. The terrace measures about 400×295 feet, the long axis north to south, and the short axis parallel to the lake shore. It is faced on all sides by large, fitted and dressed blocks of lava stone. Corner stones, notched stones, well fitted joints, and the general nature of the dressed stone all suggest Tiahuanaco style, but we did no digging to confirm this opinion.

Continuing our journey back across the lake to the southern shore, we worked along the eastern side of the peninsula of Taraco. There we excavated for some time, making a cut through the artificial mound at Chiripa. The Chiripa mound is about 100 feet in diameter, and still preserves traces of a cut stone square temple or fort on top, and part of a cut stone facing wall around the outer edge. Parts of the cut were excavated to a depth of over 15 feet before the undisturbed base of the mound was reached.

Around the center of this mound we encountered a circle of adobe and small stone house foundations. Two of these houses were completely excavated in the time we had to work, and an estimated twenty or more (which would have completed the circle) were left untouched. The base of the house walls still stands over three feet high. One house foundation measures a little less than thirty feet long and twenty wide.

A SLIDING DOOR

The walls are double, about 2 feet apart, leaving an inner room measurement of about 10 by 20 feet. The space between the walls is hollow and the bins thus formed are entered from the inside through small windows. The walls are well finished on the inside with a clay plaster, fired and polished, and around the window-niches that enter the bins are step-sided borders. The large house has nine windows into the inner wall bins, and three inset cubby holes to complete the decorative effect around the room. There are no windows that extend to the outside and but one doorway. The outside wall turns in to form the door passage, and the inner wall, thick at this point, contains a long, vertical slot, the length of which corresponds exactly with the width of the door opening. The only explanation for this construction is a sliding slab doorway, and this idea is confirmed by a niche, cut opposite the slot to receive the slab. In one house the doorway consists of two slots for sliding panels, one above the other.

The entrance floor is paved with flat stones, but the inside room has a floor of hard packed clay. The room was filled with the debris of the upper walls which had fallen in and covered the foundations, but the remains of quantities of charred twigs and burnt clay suggest that the roof was of thatch and mud. The walls of the original house were probably about six or seven feet high. On the floor of the house we found many pieces of broken pottery, bone needles and tools, stone axes, grinders and grindstones. We found burnt quinoa grain of the two varieties still used by the Indians today. The pottery fragments come from plain cooking bowls and painted vessels. The painted wares, a new type to us, are mostly straight-sided, flat-based bowls, decorated with yellow triangles painted on a red background, and also embellished with modeled animals in appliqué relief.

Under the floor of one house we found a dozen burials, some in well-covered tombs, still preserving traces of the covering cloth.

Cloth samples are rare in the rainy section of Bolivia, and so these, although plain and in bad condition, have considerable importance. Beads and pieces of metal were found in the graves, but no pottery. All indications were that the burials had been made, one by one, while the occupants continued to live in the house.

HISTORICAL SIGNIFICANCE

Most important for our archaeological study was the finding of intrusive graves, containing decadent style Tiahuanaco pottery, cutting into the walls of the house from above. This very definitely classifies this new type house site with its new pottery type as older than the later phases of Tiahuanaco. Our cross-section analysis led us to the conclusion that the house builders had started the mound, built it up a bit, and then made a circle of houses, corner touching corner, and all entrances on the inside. Perhaps there was a reservoir in the center of the circle. Then the village was deserted or destroyed and the tops of the walls fell in, preserving the foundations. Later, the Tiahuanaco people used the mound, building it up higher, and making their temple or fortress of cut stone in the center. This is the reconstruction of events that our excavation suggested.

While we were still excavating at Chiripa, our friend, Sr. Pacheco, paid us a visit. He mentioned that he had seen cut stones on a hill on the lake shore to the east. We went with him to examine the site and thus came across a new ruin, that of Lucurmata. The hill was quite extensive but there was one flattened section which had every indication of being a temple site. The hill had an excellent location, commanding a view of the lake for miles around, overlooking the farm land along the lake flats.

We made the proper arrangements with the Museo Nacional de Tihuanacu, and planned to start excavating on the eastern side of the flat hilltop. Here the owner of the land, Sr. Ambrocio Viganó, had dug a small pit revealing two elaborately cut lava



A semi-subterranean temple of well-cut stone blocks was discovered on a hill at Lucurmata



Stone-covered tombs were found under the house floor at Chiripa

The Indians

Great dressed slabs of red sandstone formed the central stairway of a Tiahuanaco type temple on the island of Cumana





The rising lake has partially covered the walls of this temple on the peninsula of Copacabana

of Yesterday

The statue which guards the small, low island of Wata



An outside view of the entrance to the Chiripa house shows the long slot which was once used for the wooden panel of a sliding door



blocks which were apparently part of a temple. Our work confirmed this, and it was seen that the two stones form the corner entrance to a small, thirty-foot square temple. The two pillars first discovered are the only two uprights in the temple. The rest of the stones are cut and smoothed granite blocks. There were once two tiers of these blocks and the lower one is still more or less in position. The upper tier has, however, fallen into the center of the temple. Many of the stones from the upper tier have a projecting ledge and inset step-sided niches for decoration.

A PARTLY SUBTERRANEAN TEMPLE

The clay floor of the temple is about six feet below the ground surface level. Several features suggest that the temple has always been partly subterranean and probably open. First the walls are aligned on the inside, but the different blocks vary greatly in thickness, thus making the outside facing very irregular. Then all stones from the second tier have fallen towards the center. Finally, a well-cut drainage canal was found in the northeast corner. This canal is cut directly through the side wall block, and based with a U-shaped slab. The canal starts at the floor level of the temple and slants down and out towards the edge of the mound some fifteen feet away.

This temple is of true Tiahuanaco style in form, decoration, and stone cutting. The pottery is also typical of Tiahuanaco. On the floor of the temple eighty per cent of the pottery fragments found are from modeled puma incense bowls. In this type the bowl forms the body of the puma, and has a modeled tail at the back which serves as handle, and a modeled, hollow puma head at the front from which issues the incense smoke.

West of this small temple, still on the flat hilltop, we uncovered a terrace wall of upright and horizontal cut stone blocks and pillars. This is about 165 feet long and has

three stairways, one in the center and one on each side, which lead up the terrace. The wall is extended from north to south and only the outside face of the terrace (i.e. the east) is finished and aligned. The stone-faced wall is backed by a rubble fill. Many of the stones in the wall are notched for fitting. Back of the central gateway is a large lava block with a square projection from one end, and back of this a set of two steps leading to a stone-paved area now badly destroyed. At the north end of the terrace wall is a peculiar path of flat stones, slightly hollowed on one side, as if for a simple canal. This path starts near the surface at the end of the wall and curves down and in until it ceases as mysteriously as it begins.

All around the flat-topped hill are cut stones, including one set of four steps hewn from a single lava block. Evidences of destruction are on every side. The terrace wall has many stones missing. It is quite possible that the small temple is of more recent construction than the terrace wall, and really is made of stones gathered from the older ruins. The whole hilltop was once a terraced, open temple of classic Tiahuanaco type. The destruction (or perhaps the rebuilding) started even in the pre-Inca times.

A twenty-minute balsa ride from the shore in front of this temple site takes one to a small island. As it is but a hundred feet in diameter and barely two feet above the water, it is uninhabited. Yet here we found two statues. One was in three pieces but the other, still well preserved, was of typical Tiahuanaco style. Both statues probably were brought from the temple on the shore, but the Indians say a lightning bolt struck the couple stone dead as they fished from the island. There they remain, at all events, as a reminder of the surprises and mysteries in store for the archaeologist who employs every mode of travel, not excepting the lowly balsa, in his researches and exploration around Lake Titicaca.

Pangolins

An account of certain strange anteaters of
Africa and Asia

By

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THE mammals, by definition, grow hair, but there are some creatures, mammals beyond all doubt, which grow so little of it that they nearly miss the badge of their class. Such a group is that of the pangolins, bizarre anteaters which have largely sacrificed the typical coat for one of large, overlapping, horny scales, worn practically everywhere except over the face and the underparts back to the tail. Hair is greatly restricted, in some species, to small areas around the lips and eyes. Other forms carry a well developed coat on the underside. Those species occurring in Asia have a few long hairs protruding between the scales.

Europeans have devised or adopted several names for these animals, such as manis, scaly anteater, and pangolin. Somewhat more picturesque are certain native names which translated are: "cinnamon-bark" (Arab); "stone-reptile" (Hindu); "jungle-carp" (Hindu); and "hill-carp" (Hindu).

Like those other creatures with flexible dorsal armor, the armadillo, the hedgehog, and the pill-bug, the manis, when put on the defensive, curls up in a ball, keeping the plates on the outside and the soft under-surfaces unexposed. Because of its thick tail and the protruding scales, the pangolin's simulation of a ball is less perfect than that of an armadillo. It has indeed a leafy appearance that has caused visitors to my office, when seeing a curled up skin fresh from the field, to enquire whether the object was an artichoke or a pine cone.

The scales which give this order, the Pholidota, its chief character, are not generally considered a carry-over from the scaly reptilian ancestors of mammals, but instead a secondary development associated with their peculiar feeding habits. The embryological history of these scales indicates that

they have arisen from the fusion of bundles of hair, in much the same manner as rhinoceros horn. To suggest that these scales arose because they were needed would of course be heresy, but the correlation of structure with habits is in this instance an easy one. There are indeed so many advantages in this suit of armor that it would be difficult to devise another covering that would serve in such good stead. To begin with a factor which seems the most important, the pangolins have completely lost their teeth, and, not being particularly rapid animals, they are open to the attack of any creature having a taste for flesh. However, the scales are tough, and in most species rather sharp-edged, so that when an animal is rolled into a sphere it is well nigh impregnable to any but the largest predators. Scales are not the only protection afforded these animals, for some species climb away from danger, some escape into tunnels, and all are equipped with an efficient stink-gun capable of being used with demoralizing effect against any animal so indiscreet as forcibly to unroll one of these. The fluid ejected from the pouch near the root of the tail is not only ill-smelling but possesses an acrid quality which, by action on mucous membranes, gives marked distress to the dog or other creature that serves as a target.

Though there are many animals in the world known as anteaters, the pangolins are apparently the only creatures which specialize in eating true ants, the other "anteaters" preferring the less dangerous antlike termites. But, in Africa at least, the pangolins fear no ant, sometimes going deliberately after army ants, insects which, though small, are formidable for their aggressiveness and great numbers. The formic acid carried into the

Flexible Armor

The long-tailed pangolin suggests a shuffling of parts of an artichoke, a skunk, and an octopus, yet cannot be converted into a table delicacy or a comforting coat collar. The tail, second only in usefulness to an elephant's trunk is, on demand, a coat of mail, a broom, a prop, a climbing iron, a fifth climbing appendage. On the underside at the tip, the tail bears a sensitive fleshy pad which serves as an informer where the eyes are not directed



Herbert Lang, Photograph

Above: It would seem as though the pangolins converted the exoskeletons of the ants into armor for themselves, so strong and polished are their horny scales

Herbert Lang, Photograph



Right: A youthful giant.
As most others of its group,
the giant pangolin walks on
its knuckles and the sides of
its feet. Thus the claws are
kept sharp for digging. No
ears or soft eyelids furnish
hold to the ants



Herbert Lang, Photograph

Below: Tied in his tail.
The arboreal pangolins
are said to rest curled up
in the fork of a tree,
though it is certain, in a
different pose than this



Herbert Lang, Photograph



skin by an ant bite is so unpleasant that we may well imagine the taste for ants must have been a long time in acquisition. The manises do eat termites with great frequency, and it is said they are not above picking up an occasional beetle or even a worm, but such digressions are not an indication of an omnivorous diet.

STRANGE "USES" FOR ARMOR

It is to be marveled at that the pangolins have the courage to feed on a column of driver ants, but we have the authority of Herbert Lang that they will do this. Most other animals, and a few nimble birds are notable exceptions, flee from these hordes that are capable of overcoming animals of large size. The armor-clad scaly anteaters, in spite of their success among the ants, are not invulnerable to attack, and when the ants do succeed in swarming over an individual, the scales are set violently quivering, and the invaders, if they have not seized a bit of exposed skin, are sent flying off into the air.

This process is somewhat less picturesque, though certainly more normal than the account of some Asiatics which states that the pangolins deliberately erect their scales to entice the ants to go for the skin, and when a sufficient number have done so, the pangolins quickly flatten down the scales and crush the ants. To complete the act, the crafty pangolin walks into the water, raises its scales, and thus permits the numerous dead bodies to float to the surface, where they are picked up and eaten.

The scales, though not used as antkillers, have great potentialities for injuring an animal molesting the pangolin. The great forest pangolin of west Africa which, it is estimated, may weigh more than sixty pounds, is in truth a very dangerous animal to handle. Bordering the tail are scales which are sharp-edged; the tail of the coiled manis, sweeping swiftly and with enormous force over the edges of the back scales, has the effect of a lawn-mower blade on anything intercepting its course. A three-inch native

knife has been doubled over under such circumstances. In the northeastern Congo, where natives occasionally go down into pangolin burrows to capture the animals, they undertake a task which not infrequently has meant the mutilation of their hands. Usually the hunters are armed with a spear and do not risk a close encounter.

Scales on the arboreal pangolins have proved useful under still other circumstances, as attested by Mr. Lang, who observed that they may fall, coiled up, from the highest tree without suffering injury, the resilient scales and strong skin muscle being sufficient protection against the shock.

Specialization in feeding habits is invariably accompanied by profound modification of the animal's structure. In the case of the *Pholidota* the presence of protective scales is but a small part of the change. Strong curved claws on powerful fore limbs supply the means of breaking into the habitations of their prey, and stout rear limbs and tail form a solid base for such operations. Additional protection against the onslaughts of angry ants is given by the swollen, thick eyelids, and the reduction of the ear conch to a small fold of thickened skin behind or above the ear. Not only may eyes be covered but even the ears and nostrils are capable of complete closure.

The marvelous ability to engulf ants and render them powerless with rapidity, is an important part of the feeding process. Pangolin tongues, particularly those of African arboreal species, are several times as long as the head, a development made possible by a unique elongation of the sternum and the associated tongue muscles. The long, thin tongue can dart in and out with snake-like rapidity and, twisting in among the galleries of an ant colony, it picks up and draws back into the ant-chute mouth all the animals it touches. Enormous salivary glands furnish an abundant supply of a thick, sticky substance to the surface of the tongue, which holds the insects captive. On the lightning-fast withdrawal of the tongue into its groove in the floor of the mouth, the ants

African Pangolin



Herbert Lang, Photograph

Fearful,
Yet To Be
Feared

Pangolins are not aggressive but the giant species can do great damage with their massive axe-edged tails. This weapon is swung over the body with such force that a knife an eighth of an inch thick, stabbed in its side, has been doubled over



Scales and Tails

Above: The baby manis uses its mother's tail as a perambulator.

H. Lang, photograph

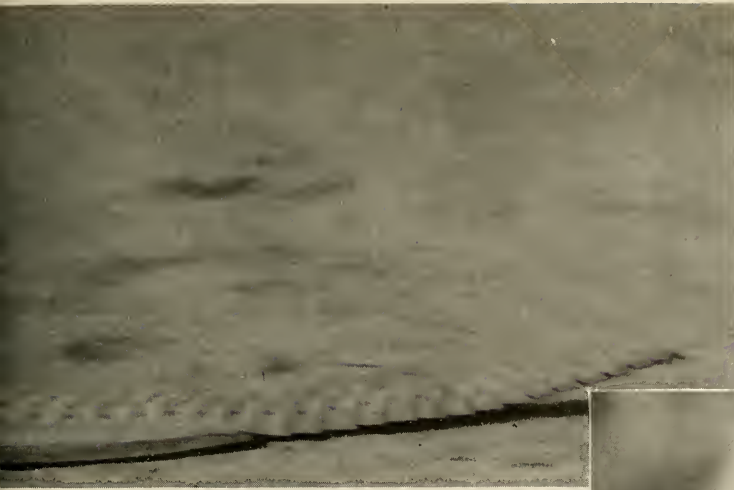
Left: Unlike the African, this Bornean pangolin has prominent ears. H. C. Raven, photograph

Right: Asiatic manis often end up in Chinese pharmacies where their scales, as do dragon tears, form part of the *materia medica*. T. Donald Carter, photograph



Herbert Lang, Photograph

Below: The long tail of this African species is kept circled about the tree trunk as the creature descends. If hurried, the manis may coil and drop from a great height without injury



Herbert Lang, Photograph



✓
Left: The longest tail. The west African yellow-scaled manis has the longest tail of any of the species, and one of the longest mammal tails in the world

are swept off into the throat and hastened with a further addition of fluids into the stomach, where the hydrochloric acid and the grinding equipment make short shift of any resistant individuals that may have survived this long. The stomach is in fact transformed into a gizzard-like organ in which operate strong muscular grinding forces aided by pebbles picked up by the pangolin. Lacking teeth, the pangolin as it were, stones its prey to death in the same manner that birds grind hard seeds in their gizzards, and the crocodiles triturate meals too hastily swallowed.

This curious occurrence of stones in the stomach was known before much about the habits of the pangolins was established, and, supposedly, on the finding of a specimen in which no food was present in the stomach, one contributor to a journal of researches seriously discussed the proposition that a manis might live entirely on mineral substances, a suggestion that would be difficult to equal for absurdity.

THE USEFULNESS OF A PANGOLIN'S TAIL

Those manis that can climb are equipped on the undersurface of the tail with a tactile pad which allows them to explore their environment for a suitable grasping place when their eyes are directed elsewhere. The tails of these animals are even more useful to them in the trees than the tail of a spider monkey is to its owner, for, when they ascend, the tail serves as a prop in the manner of a woodpecker's tail, and during descent, may completely encircle the trunk of a small tree, allowing greater freedom to the legs.

The pangolins are silent animals, and are not known to produce any noise through the mouth other than a hiss. The young at birth have much of the appearance of adults except that their scales are soft and the color is lighter.

The Africans prize the pangolin not only as a welcome source of meat, but in some sections it is said that the arboreal species are

kept around the house for the purpose of eating the ants and termites. A more curious value relates to their scales which in parts of Asia are supposed to possess aphrodisiacal powers and hence are in some demand. In Kenya, I am told, the blacks believe that pangolin scales have the power of rejuvenation, which one may presume represents a good example of faith healing. Some primitive armor simulates pangolin scaling, but I have not learned of any actual instance of pangolin scales being used in the fabrication of such a suit.

DIFFERENCES

Asiatic and African pangolins present clear-cut differences, and it is the former group that is the more primitive in its general total of characters. One instance of this is that no hairs occur between the scales of the African species, whereas hairs are characteristic of the Asian. More striking is the difference in the sterna, anchorage for the tongue muscles, which in all Asiatic species is relatively short, simple, and primitive, and in the African greatly elongated and divided into branches which may unite with the ends of the last pair of ribs. The external ears of the Asiatic species, though not well developed, form a distinct fold around the orifice, whereas in the African the ears are not marked, in adults, by even this small eminence.

The difficulty of feeding these animals in captivity makes them one of the greatest rarities in zoölogical gardens, and this is in good measure the reason for their being little known by the public. The suggestion was once made that they might profitably be imported to the tropics of the New World to fight the destruction of fruit trees by leaf-cutting ants, but to the best of my knowledge this never has been done. So it is that anyone in the Western Hemisphere, to see them alive, must, like Mohammed, go to the less mobile object, in this case not the mountain, but the manis.

Earthquakes

An account of the sharp movements of the earth that often bring tragedy to the inhabitants of certain regions, together with an explanation of the instruments that record these movements

by
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THE needles on the seismograph in the American Museum may suddenly, without a moment's notice, begin to trace on moving sheets of paper a threefold series of wavy lines, which represent vibrations that have passed through the earth—somewhere there has been an earthquake and the seismograph is making a graphic record of it. If the shock is sufficiently strong, other seismographs in various parts of the world will inscribe a record of the same quake at approximately the same time. The vibrations from a strong distant quake may continue to arrive for an hour or more; those from a small near-by quake will be recorded in a much shorter time.

An earthquake is produced when the materials composing the earth are broken or displaced. The materials are hard, brittle, and elastic, and they will resist change until the forces acting upon them develop stresses greater than their strength, then they will yield suddenly and produce not only a fracture, but a shock. A sudden yielding of rocks to earth strains may give rise either to a new fracture or to movements along a previously existing fault. When a sudden movement does occur along a new or old fault, the frictional resistance offered by the opposing rock walls no doubt contributes its share to the development of vibrations. Whatever happens, the sudden shock releases energy, vibrations are set up and waves are transmitted through the earth in various directions to seismographs situated at different distances from the point of origin. The greater the dislocation, the greater the vibrations set up, and the greater the distance the waves will travel.

In the United States 62 major earthquakes and many smaller ones were recorded

instrumentally for the year 1933. The average annual number of earthquakes locally sensible to human beings is about 4000. Of this number, about 70 are major quakes capable of instrumental registration over a hemisphere or the entire globe. There are some 200-odd seismological stations scattered over the surface of the earth. Many of these stations contain only a pair of seismographs, the larger stations contain three, four, or more makes of instruments, each with a different degree of sensitivity, and capable of registering, not only the horizontal, but also the vertical components of an earth shock. It has been recently estimated that the number of earthquakes, which probably occur annually, and which are susceptible of instrumental registration, approximate 8000. A limited number of modern seismographs have been in use for the past 35 years. During this period, it has been estimated that nearly 2500 major earthquakes have been recorded, and about 140,000 smaller ones, which may have been felt locally. The number which probably occurred, both large and small, and which may have been strong enough for registration by present-day instruments, may have amounted to 240,000. It may be noted thus that earthquakes are not of infrequent occurrence.

In recent years the citizens of the United States and of other countries have manifested a widespread interest in the occurrence and distribution of earthquakes and in the kinds of instruments which have been devised for recording them. With the gradual increase in the number of seismological stations in various parts of the

A view of the wreckage of the city of Melfi, Italy, after the earthquake of July 23, 1930. Almost the entire Mediterranean is included in the geologically "young" zone that continues across Asia Minor and the Himalayas to the East Indies and beyond



Italy

Taormina, Sicily, looking toward the active volcano, Mt. Aetna, and with the ruins of an ancient Greek theater in the foreground. Taormina and Messina were severely shaken in 1908. The loss of life exceeded 100,000. The famous volcano of Sicily and the fact that earthquakes are not uncommonly felt in the island, demonstrate its geologic youth

Publishers Photo Service





Wide World Photograph

An aerial view showing the ruins of Miyagi, Japan, as they were burning, following the destructive earthquake of March 3, 1933

Japan

Looking across Shoji Lake toward Fujiyama. This particular volcano is quiescent but others in Japan have played their part in the periodic earthquakes that are common in the Japanese archipelago

© by E. M. Newman.
Publishers Photo Service



civilized world, together with the improvements that have been made in the different types of self-recording instruments, there has been a marked increase in the number of earthquakes recorded.

THE COMPOSITION OF THE EARTH

The study which has been made during the past few decades of seismograph records has revealed that the earth has a crust composed of solid material, and that it has a thickness variously interpreted as being 40 to 60 miles in depth. The irregular configuration of the earth's outer surface is a matter of common knowledge. The highest point of land, represented by Mount Everest, has an elevation of 29,141 feet; the greatest depth of the sea, known as the Swire Deep, off the east coast of the Philippines, measures 35,433 feet. The maximum relief of the earth's surface is thus approximately $12\frac{1}{4}$ miles. The average height of the land, however, is but 2,300 feet above sea level, or nearly a half mile, while the oceans have an average depth of 11,500 feet, or a little more than two miles. The difference in relief between the average height of land and the average depth of the oceans is thus 2.6 miles. Only 28 per cent of the earth's surface is above sea level, the remaining 72 per cent being below. In other words, one part is land while nearly three parts are covered by water. This relative distribution of land and water is in keeping with the location of earthquakes, for maps showing the distribution of earthquake epicenters, for periods of one or more years, show that earthquakes are far more abundant at sea than on the land. It has been recognized by geologists and other scientists that the earth's surface has an irregular relief, because of the presence of materials of different densities near the earth's surface. Under the continents the densities, which average 2.67 times an equal volume of fresh water, are less than they are for the materials under the oceans, which are of the order of 3. The average density of the entire earth is considerably greater. It is 5.6 times as much as

an equal volume of water. As a consequence, the materials of the inner parts of the earth must be denser and heavier than those of the outer crust.

We know, too, that the crust of the earth is rigid, although it is composed of materials of different consistencies, for, otherwise, the high areas would slump down and the materials composing them would move forward to fill the valleys, the ocean basins and their deeps, and produce a true spheroid, which would be covered with water to an average depth of about 7,500 feet.

The length of time during which the earth has had this irregular configuration is not definitely known. It has been long and may be of the order of the oldest known rocks, which are now regarded as exceeding a billion and a half years. High mountains such as the Alps, Andes, Caucasus, Himalayas, Rocky Mountains, and Sierra Nevadas have not always been high, for they are of comparatively recent origin geologically speaking; older mountains, such as the Appalachians of the United States, the Caledonian and Hercynians of Europe, have been greatly reduced in height by the action of the agents of erosion during many millions of years. The still older Laurentides of Canada, and the upturned strata of Manhattan Island and the adjacent mainland of New York have been reduced by these same agents of erosion to rolling uplands. Their present relief does not suggest mountains, but their geologic structure does. We may conclude from this evidence that while the high spots of the land and the low places of the sea have not always been where they are now, the relative distribution of the continental land masses and the oceanic basins has, with minor variations, remained more or less constant for vast geologic ages.

WHAT HAPPENS WHEN THE EARTH QUAKES

In regions where large earthquakes occur, it has been noted that either vertical or horizontal changes, or both, take place in the crust of the earth. The amount of change produced at any one time may be of

the order of a few inches or a small number of feet, and have a lineal extent of either a few miles, or as in the San Francisco earthquake of 1906, of several hundred miles. In the course of irregular periods, of long or short duration, earthquakes may recur in the same place or in closely adjacent areas; the combined result of a number of such recurring earthquakes is to produce a well marked change in the configuration of the earth's surface at that place. Earthquakes, which accompany either vertical or horizontal changes in the surface of the earth, are not only happening now, but they have occurred frequently during the past history of the earth. In fact, there is no portion of the earth's surface which is absolutely free of faults, those large fractures, which appear as mute evidence that earthquakes have occurred along them at one time or another during the past history of the earth.

It is also true that during past geologic ages parts of the earth's crust have been either down-warped, uplifted or broken, and in many cases, tilted. Evidence of this may be seen in many of our highest mountains where beds of limestone, sandstone, or shale, which contain fossil remains of shells that once lived in the sea, have been found at high elevations. Volcanoes also periodically bring up molten materials from great depths and pour them out at different elevations on the earth's surface. It would be of interest in this connection if we knew more precisely from what depth this white hot lava arises.

WHERE EARTHQUAKES ORIGINATE

The depth at which earthquakes originate is a problem concerning which we would like to have more precise data. Many earthquakes produce evidence of shift of earth-blocks at the surface of the earth, others leave no trace of such movements. While some earthquakes undoubtedly occur near the surface, with movements extending downward, others appear to be deep-seated. A study of Japanese earthquakes by K. Wadati, 1928, shows that they may be either

shallow or deep-seated. The shallow ones have an average depth of 25 miles, while the deep-seated ones may originate at depths of more than 186 miles. A few other investigators have made studies of this problem with varying results. The studies of B. Gutenberg in 1929 of sixteen different earthquakes show that the focus or point of origin of these quakes lies, with a few exceptions, at a depth of 28 miles or less. Some investigators of this problem say that, if the velocity of propagation of seismic waves through the uppermost layers of the earth's crust were more precisely known, there would be less uncertainty in determining the depth at which earthquakes originate.

SEISMOGRAPHS AND EARTH VIBRATIONS

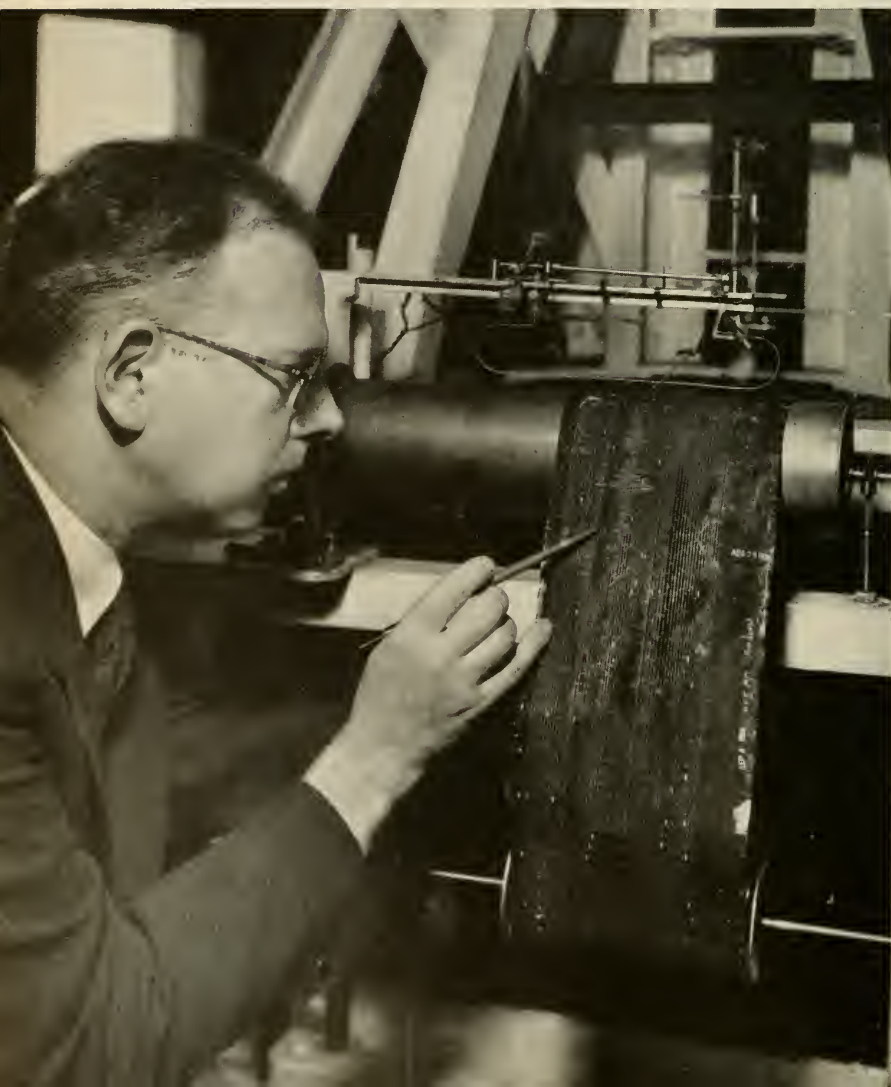
Seismographs are instruments designed to record the vibrations transmitted through the ground. During a great earthquake two things are apt to happen, namely: (1) There will be a lurch or displacement of the ground, either horizontal or vertical, or horizontal and vertical, the range of which may amount to 20 feet or more. The amount of displacement will not be recorded by the seismograph. It may be determined by resurveying the ground. (2) Vibrations will be set up in the ground.

All earthquakes develop vibrations. The period of the vibrations may vary from a fraction of a second in near earthquakes to 20 or 30 seconds in distant earthquakes. No one seismograph will record all of these varied tremors. Due to limitations in construction and recording, different types of instruments are required for the registration of near and distant earthquakes. A third type of instrument, known as a tromometer, is needed for registering the minute tremors which precede and accompany volcanic eruptions. A fourth type of seismograph is required for those regions where great earthquakes occur, for there the motion is apt to be so strong and vigorous that any machine designed for the registration of other types of earthquakes would be damaged or thrown out of action.



Seismograph

The photographs at the left and below show the seismograph at the American Museum of Natural History. The record which is being examined by the observer below records an earthquake of moderate intensity in the ocean bed on August 29, 1934. So accurate and sensitive are these instruments that though thousands of miles may separate them from the center of the earthquake shock, a study of the record will often determine the quake's location



Above: The seismographic record above and the one parallel to it on the opposite page are in reality two parts of one record, made on November 20, 1933, on the American Museum seismograph, recording a quake in Baffin Bay. Seismological stations have reported these shocks as being among the strongest ever recorded



*Photograph by
Charles C. Mook*

Above: Trouble for a railroad. This view, taken immediately after the earthquake of July, 1925, at Three Forks, Montana, shows the havoc wrought on a railroad line by the displaced masses of rock loosened by the earthquake

Earthquake

A crack in the earth photographed after the earthquake of July, 1925, at Three Forks, Montana, not far from the spot pictured above. Such cracks in the earth are not uncommon after earthquake shocks, and sometimes can be traced for considerable distances

Photograph by Charles C. Mook



Each kind of seismograph consists of five essential parts, namely: (1) the "steady mass" which remains or should remain quiet during the time of an earthquake; (2) the framework which supports the "steady mass"; (3) the recording apparatus; (4) a damping device whose function is to keep the "steady mass" quiet; and (5) a pier constructed in such a manner that it stands free of buildings and is firmly connected to the ground.

THE MAINKA SEISMOGRAPH

In the American Museum installation there are two horizontal pendulums, known as the Mainka seismograph and built precisely alike and set at right angles to each other. One is placed in a N-S direction, the other in an E-W plane. The N-S instrument registers the E-W component, the E-W instrument the N-S component of an earthquake movement. The "steady masses" in these two seismographs have been painted black. Each consists of a series of 16 alternating iron and lead discs which have been stacked in such a way that they make a cylinder $15\frac{1}{2}$ inches in diameter and 22 inches high. The weight of each "steady mass" is 450 kilograms or nearly 1000 pounds. Each "steady mass" is suspended from a sturdy angle-iron frame, painted white, which rests upon a concrete pier. The top of the pier, which has dimensions $3' 8'' \times 5' 8''$ and supports both instruments, is level with the first floor of the Museum building. It is not connected with the building, however, for an air space separates them. The pier, which extends downward 24 feet, has its lower half firmly imbedded in Manhattan schist. The upper half of the pier passes through the basement of the building and there it is surrounded by a wall of hollow tile. This tile wall not only protects the pier, but it keeps the air surrounding the pier of a uniform temperature. Air conditioning of seismograph piers is an important matter, for, if not attended to, the seismograph records are apt to show unnatural earth tilts brought about by un-

equal changes in temperature in the piers.

The mode of suspension of the "steady masses" varies in different types of instruments. The "steady mass" may be supported in such a manner that it represents either a common pendulum, an inverted pendulum, or a horizontal pendulum. In these various types of suspension, the equilibrium of the "steady mass" is respectively stable, unstable, and neutral. Of these three types of pendulum the horizontal one offers the least amount of difficulty in providing a "steady mass," which is essential in an accurate seismograph. The horizontal pendulum, therefore, is the one generally used in the construction of seismographs. A door or gate swung on two hinges is a common example of this type of pendulum.

In order that the horizontal pendulum may have a small amount of stability and may return to its initial position after displacement, the axis of support is tilted slightly toward the center of gravity of the "steady mass." Swinging doors and gates also readily come to rest when they are not hung perfectly true.

THE ARRANGEMENT OF THE "STEADY MASS"

In a simply constructed horizontal pendulum the "steady mass" is usually firmly attached to one end of a boom; the other end of the boom, which is free, ends in a steel point which is pivoted in an agate cup near the base of the mast or supporting frame. The weight of the "steady mass" is supported in mid air by a wire stay, which is attached at one end to the weight and at the other to the top of the mast. This mode of attachment not only keeps the "steady mass" free of its supporting frame, but it permits adjustment of the angle which the boom makes to a horizontal plane passing through its pivoted end. This angle affects the period of the instrument, in other words, the number of vibrations which the "steady mass" will make in a second, when touched lightly with the finger. For near earthquakes a period of four to six seconds is suitable; for distant earthquakes one of thirty seconds or even greater is desirable.

In the American Museum installation of the Mainka seismograph the "steady mass" is kept free of the supporting frame by a Y-shaped yoke, the two distal ends of which are attached to the sides of the mass, while the free proximal end is fastened to the frame in such a way that a knife-blade spring is kept under tension. The lower end of the supporting stay consists of a bridle fastened to the two ends of a pipe which passes through the center of gravity of the "steady mass"; the upper end of this support terminates in a wire which is attached to the top of the supporting frame. The suspension is so delicately adjusted that, if the "steady mass" is slightly touched with the finger, it will swing back and forth in a horizontal plane and the vibrations will be registered by the recording needle on smoked paper. From such a registration the natural period of the instrument can be obtained. In this connection it may be stated that a seismograph is most sensitive to those waves which correspond to its own natural period of vibration. The period of the machine is noted at the beginning of every record. New sheets of paper are placed on the instruments, usually at the end of every forty-eight hours.

THE "DAMPER"

The movement of the "steady mass" when touched is just the contrary of what happens when an earthquake occurs; then the earth, the concrete pier, and the white supporting frame vibrate as a unit while the "steady mass" remains quiet, at least for a time, when it may begin, if not damped, to pick up the earth's vibrations transmitted through the supporting boom and stay.

The damper which is placed upon the side of each supporting frame consists of a rectangular metal box, a pair of round air holes near the top with adjustable covers, a sheet of metal within the box which acts as a diaphragm, and a set of rods which connect the diaphragm with the center of the "steady mass." This is an air damper; oil and magnetic dampers are also used on some types of seismographs. The damper

offers resistance to any sudden movement which may take place, especially the tendency of the pendulum to swing in its own natural period when an earthquake occurs.

HOW THE RECORDING APPARATUS OPERATES

The recording apparatus in each instrument consists of a connected series of multiplying levers. One end is attached to the center of gravity of the "steady mass"; the other end is a freely moving well-balanced recording needle which lightly touches a moving sheet of smoked paper. These levers magnify the earth tremors 100 times. In order that the earth movements which pass through the pier and supporting frame may be registered with reference to the "steady mass" which remains quiet, the recording levers are also attached to the center of the "steady mass," the diaphragm of the damper, and to the supporting frame. In addition to the multiplying levers, the recording apparatus in the Mainka seismograph consists of a pair of revolving drums on which sheets of smoked paper 15×90 centimeters in size, and joined at the ends, rotate past the point of the recording needles. The movement of the drums and smoked paper, which is at the rate of 15 mm. per minute, is controlled by a weight and governor. Minute and hour dots are marked on the sheets of smoked paper by a pointer, which is controlled by a master wall clock having electrical contacts.

Normal registration of a Mainka seismograph appears to consist of a series of parallel lines traced by the needle on smoked paper. Actually the needle traces a continuous line of closely appressed spirals, as when a garden hose is coiled up, for the paper moves over slightly as it climbs the higher side of the gently inclined drums.

During an earthquake the needle swings back and fourth across the paper and thus inscribes the vibrations of the earth which usually arrive in three phases known as the First Preliminary tremors, *P*; the Second Preliminary tremors, *S*; and the Main Waves, *L*. In distant earthquakes one or



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The photograph at the left, taken at Compton, California, shows how the wall of a building crumbled away as the result of a quake. Below is a view of San Francisco which in 1906 was fearfully damaged by an earthquake followed by fire

California



New Zealand

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The photograph at the right was taken at Napier, New Zealand, Feb. 3, 1931, while an earthquake was still in action in the vicinity. The view below is at Auckland, which was shaken by the great quake of 1931. New Zealand is periodically subject to earthquake shocks



two reflections of these waves at the earth's surface may occur, at one-third and two-thirds the distance, and be recorded as superimposed phases. The first case may be designated as PR1, SR1, and the latter as PR2 and SR2. The seismograph record of such tremors indicates not only the paths by which the various kinds of waves reached the instrument, but also the properties of the materials through which the waves passed. The earth thus not only writes its own epitaph, but this inscription is full of meaning and is worthy of our careful inspection. For distant earthquakes, the beginnings as well as the continuation of the different phases of the record are indicated on the seismogram by sudden or gradual increases of amplitude, by sudden change of period, or both, and by the order of succession in which they occur. For instance, it has been determined that the P-waves, the first to arrive, are longitudinal or compressional waves with vibrations in the direction of progress. They are fast and of small amplitude, usually less than a millimeter. Their velocity near the surface is 7 to 8 kilometers per second and their period varies from 5 to 7 seconds. They usually follow a direct path from the point of origin to the recording seismograph, but a curved one, since in passing through, they dip toward the center of the earth where the rocks are denser and their rate of propagation is faster.

WAVES AND VIBRATIONS

The S-waves are transverse or distortional with vibrations at right angles to the direction of progress. They are slower than the P-waves, and have a velocity near the surface of about 4.5 kilometers per second. Their period is 11 to 13 seconds. They follow approximately the same path as the P-waves.

The main or long waves, L, which pass around the surface are complex longitudinal waves. Their velocity is 3 to 4 kilometers per second, depending on conditions. According to N. H. Heck, chief seismologist of the U. S. Coast and Geodetic Survey,

their velocity under the Pacific ocean is about 20 per cent greater than under the continents. Their periods vary greatly and may be as large as 40 or 60 seconds.

The P and S waves of sharp, well defined single shocks can be definitely differentiated on a seismograph record for those earthquakes which originate at places more than 700 miles and less than 7000 miles distant from the recording instrument. Furthermore, with an accurate timing apparatus the times of arrival of these waves can usually be definitely determined on the record, the difference noted, and the distance from the receiving station to the point of origin (epicenter) calculated, or read off from an empirical table or its graph, with an error not greater than 25 to 50 miles. By using the determined distance as a radius, and the location of the station as a center, a circle may be inscribed on a globe, or scaled map, which will pass through the epicenter. Its location on the circle may be determined by applying the same method to distances obtained from two other widely separated stations, using one or the other of those stations as the center of the second and third circles. The point of intersection of the three circles, or the center of the triangle formed by them, will be the location of the epicenter. The use of the duration of the first preliminary tremor for determining the position of the epicenter of a distant earthquake is known as the Zeissig method. It is the one used by most observers. Other methods are sometimes used but they require special apparatus.

Whatever method is used it may be noted that since 1899 there has been an ever-increasing accuracy in locating earthquakes, especially those 700 to 7000 miles distant from recording stations. The location of the main seismic areas is now well known—one belt extends around the margins of the Pacific Ocean, another forms a great circle about the earth through the Mediterranean-Caribbean regions. Other areas of frequency are less well defined, for isolated occurrences are common in many parts of the world, except

H. Armstrong Roberts, photo

Extending in a vast horseshoe from Cape Horn up the coast of the Americas across to Asia and down to the East Indies is a great band which includes mountains and islands of geologically recent formation. Most of the West Indies also are included in this region throughout which earthquakes are occasionally experienced. The view on the right was taken on the island of Puerto Rico, and the photograph below shows the Chilean Andes rising abruptly from the sea

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Athens

A view of the city from the top of the Stadium. Both Greece and Palestine occasionally feel the effects of earthquakes, for old though these regions are in the history of civilization, they are comparatively young as the geologist measures the age of the earth.

Right: A view of the Temple of Jupiter with some of its fallen columns. Many of the Greek ruins have been brought to their present condition by earthquakes

Publishers Photo Service



in the polar regions, where few earthquakes have been registered during the past thirty-five years.

For near-earthquakes, that is, those that occur within 10° , or 700 miles, of the epicenter, there is no separation, on most seismograph records, of the primary waves, P, and of the secondary waves, S, and it has been suggested that for this distance each wave possesses both types of characters. In other words, the characteristic features of these waves, condensational on the one hand and distortional on the other, are not differentiated on seismograph records made by instruments designed and set for those quakes originating 700 to 7000 miles away and known as distant quakes. Specially constructed instruments are required to separate P and S waves of near-earthquakes.

Those far distant earthquakes, which originate 7000 to 10,000 miles or farther from a recording station, do not register the P waves, as the first recorded impulses, since these waves are refracted at a depth of 2900 kilometers (1802 miles) into the inner core of the earth and produce by their refractions what is known as the "blind zone." Such refracted waves, when recorded, are designated as P' waves. The velocity of these waves just outside the central core is 13 kilometers (8 miles) per second; inside it is 8.5 km. (5.3 miles) per second.

So far as we know the S-waves originating 7000 to 10,000 miles distant do not emerge from the inner core and we may assume, since they are not transmitted through substances in a liquid or gaseous state, that the inner core, with radius 3470 km. (2157 miles) or .55 of the radius of the earth, is in a liquid or gaseous condition and composed of a molten mixture of the heavy metals iron and nickel.

The study of distant earthquake records has indicated that the surface of the inner core is a well marked surface of discontinuity, and that it refracts or reflects the waves which meet it. Some four other less pronounced discontinuities separate the zones of the earth which appear above it.

The one appearing at a depth of about 60 kilometers (37 miles) is well marked in many seismograph records. It is the lower margin of the crust of the earth.

These planes of discontinuity change the path and energy of earthquake waves.

PROBLEMS TO BE SOLVED

The foregoing discussion gives a brief resumé of the general status of our knowledge concerning the earth's interior, the propagation of earthquake waves, and the significance of seismograph records. While various seismological investigations have been carried on during the past thirty-five years, which have thrown a flood of light upon hitherto unsolved problems and hidden features of the earth, we would like to know more about the earth's interior, the elastic properties of the earth, the conditions which produce earthquakes, and the composition and structure of the layers composing the crust. Geological observations on surface indications during the past 150 years lead us to believe that the crust is composed of numerous layers of rock which are variable in number, extent, origin, structure, and composition. The recent development of seismic prospecting for oil and other minerals and the effect of the propagation of earthquake waves on buildings and other structures emphasize the importance of these researches. Daily observation and studies are being conducted by various organizations. In the United States they are being carried on by the National Government through the Coast and Geodetic Survey with the cooperation of the Weather Bureau, the Geological Survey, the Bureau of Standards, and the National Research Council. Other organizations are also coöperating, such as the Carnegie Institution of Washington, the Jesuit Seismological Association, and the various universities, colleges, and museums in different parts of the country. The ultimate aim of this study is a better understanding of the elastic conditions of the earth.

The Wild Bees

By

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IT is probable that there are not less than a thousand kinds of wild bees in Colorado.

These inhabit diverse localities, some being found only high in the mountains, others on the plains; some only in the eastern parts of the State, others to the south or west. Perhaps about three hundred species would be the maximum to be observed in any one general locality.

Not only do these bees differ in their distribution, but also in their habits and mode of life. One of the first things a collector will notice is that the kinds of bees do not indiscriminately visit all sorts of flowers. Some are rarely found except on one particular sort of flower, others range more widely, and we have caught a bee with three kinds of pollen on its legs. The domesticated honey bee works longer hours and is probably more catholic in its tastes than any native species. The student who has noticed these facts may now turn to the structure of the bees themselves, and he will quickly learn that some have very long tongues, adapted for getting nectar out of tubular flowers, while in others the tongue is very short, suited for lapping. The short-tongued bees cannot get anything from the flowers which do not have shallow, open corollas, except in certain cases, where they cut a hole in the side of such a flower as the *Mertensia*, and thus are enabled to feed illegitimately. We say illegitimately, because the relation of bees to flowers is a reciprocal one. The bees obtain nectar and pollen, but in so doing they carry the pollen from flower to flower, and so bring about fertilization. It is accordingly advantageous to the flowers to be visited by bees which confine their visits more or less to one species, as a bee carrying thistle pollen to an aster or buttercup will not be of any service to the flowers.

The distribution and habits of some of the thousands of species that are to be found in the world

We now begin to understand why there are so many kinds of bees. With more than two thousand species of flowering plants in the State, there is ample opportunity for diversity in the bee-visitors. Yet this is not the whole explanation. In the Pribilof Islands, in Bering Sea, there are many beautiful flowers, but only one sort of bee is found, a large bumblebee peculiar to the islands. It undoubtedly visits many different flowers, and the cross-pollination of the others, so far as necessary, may be brought about by flies or other insects. Florida has a very rich flora, but Doctor Graenicher, an expert student of bees, has recently recorded the relatively meager bee fauna of a locality in that State. He has probably overlooked some species, but it is quite certain that the bees are far less numerous than in our western regions. Similarly, New Zealand, with many flowering plants, has very few bees, the list being very much shorter than that for Florida. New Caledonia is in this respect like New Zealand, but Australia is extremely rich in bees.

On mapping the distribution of bees over the world, it is found that they are much more abundant in dry regions than elsewhere. The number of species in the American Southwest, in North Africa, in the deserts of South Africa, and in Turkestan, is astonishing. No doubt these regions are especially rich in plants adapted to bee-visitors, but a prime factor must be the greater facilities for nesting. It may be supposed that the relatively dry soil reduces the danger from flooding and mold, and presumably it does not contain so many burrowing animals which might be injurious.

The nests of bees, in which the young are reared, are of many kinds. We have the social bees, like the honey bee and the bumblebee, which have a definite form of

Photograph by C. R. Bitter

The long-tongued bee, known to the scientist as *Melitoma grisella*, feeds exclusively on the flowers of the wild bush morning-glory. The picture at the right shows the under side, together with the long tongue which cannot be folded up and is held beneath the body like the beak of a plant bug

(Greatly magnified)



Left: The head and mouth parts of *Melitoma grisella*. This illustrates a high degree of specialization



Photograph by C. R. Bitter

Right: A picture from above, showing *Melitoma grisella*. This bee is to be found only where the wild bush morning-glory grows. It is common, for instance, about Denver, but at Boulder, Colorado, where its particular flower does not grow, this bee is never found



organization on a communistic basis. But far more numerous are the so-called solitary bees, which often form towns or communities, sometimes including vast numbers of individuals, but have no social organization. The nests of these solitary bees are commonly in the ground, but there are some genera which always nest in old stems of plants, and others which build resin cells on the surface of rocks. It is interesting to realize that many millions of years ago, before the human species lived on earth, the bees had developed many styles of architecture, some very crude and simple, others quite elaborate. They had also learned how to collect materials of various kinds, such as resin, cottony substances, and leaves, to use in making their nests. A species of wasp (*Sphex*) had even taken to using a pebble as a tool. The leaf-cutting bee (*Megachile*) takes semicircular and circular pieces out of leaves to line its cells. It is especially fond of rose leaves, and is sometimes quite destructive. *Megachile* of different kinds are found nearly all over the world; there must be a couple of thousand species in existence. But long ago they lived and behaved as they do now, for in the ancient shales of Florissant we have found a fossil bee of this genus, and also leaves cut in the characteristic manner.

NESTS IN THE HARD EARTH

Bees may be found nesting by the roadside or in banks. *Nomia*, in Colorado, forms extremely populous towns in dry places, sinking long, vertical shafts, leading to cells in which the eggs are laid, food is stored, and the bee-grubs develop. It is astonishing that these small and apparently weak animals, using their legs and mandibles, should be able to make such excavations. The hard, dry soil would seem to increase their difficulties, but soft or sandy earth would be liable to cave in.

The making of the burrow and the provisioning of the cells are not the only operations necessary in bee-housekeeping. Various contrivances appear to have the purpose of keeping out unwelcome visitors, those flies,

wasps, and other creatures which would destroy the young. Certain flies, with fuzzy bodies, are seen continually hovering over the nests. Antlike wasps or Mutillidae, the females of which are wingless, run about and explore the holes of the bees. As these enemies are abundant, and evidently prosper, it may be thought that the bees have no protection from them. Yet we see various kinds of structures over the entrances to the nests, porches, cylinders, tunnels, and the like. The *Nomia* constructs a tunnel on the ground, into which the bee itself has some difficulty in penetrating. After a heavy rain, these structures are largely or quite demolished, and the enemies seem to gain an advantage.

THE BALANCE OF NATURE

In all this we see the balance of nature. The *Nomia* towns, in spite of enemies of many kinds, are very populous indeed. The arrangements made by the bees are quite sufficient, under normal conditions, to keep up the population from year to year. But if it were possible to remove or destroy all the parasites and predators, the result in a single season would be excessive over population, disastrous to the bees themselves. We are reminded of the conditions in the great animal reserve in South Africa, Kruger Park. Here we saw many thousands of antelopes, zebras, giraffes, and other herbivorous animals. But also, we saw many lions. The lions prey upon the antelopes, and keep down their numbers sufficiently so that they do not increase beyond the possibility of being supported by the available vegetation. The biological balance in nature is indeed a thing to wonder at. Insects produce vast numbers of young, but on the average there must be one pair each season to mature and replace the parents of the season before. This means the destruction, by one means or another, of about 98 per cent of prolific species, if the population level is kept steady. As a matter of fact, it fluctuates, and in some seasons there is a considerable increase in others the species may be locally

A Bee that Nests in the Earth

This bee—*Anthophora occidentalis*—is common in Colorado. It often nests in the same banks in which *Melitoma grisella* is found, but though they are related, in a general way, *Anthophora* is the larger



Photograph by Robert Niedrach



Photograph by C. R. Bitter



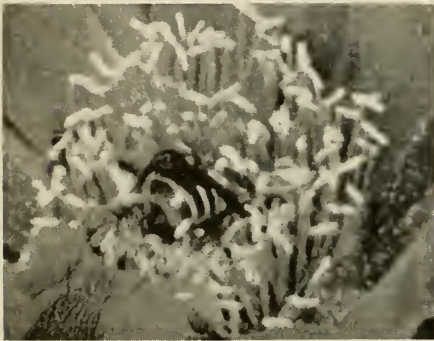
Photograph by Robert Niedrach

The large picture is of the head of a male *Anthophora*. The small picture at the top is of a female at the entrance to the nest, which is a tunnel in a bank. The small picture at the bottom shows the white markings on the face of a male, that serve to differentiate it from the female which has no such marking



Photograph by H. G. Rodeck

The three pictures in the column below show, first, a block of soil cut from a roadside near Denver in which appear the vertical tunnels of *Nomia bakeri*. Second, the nest of the leaf-cutting bee, *Megachile sapellonis*, after a log, in which the hole was bored, had been split. At the bottom of the page is a photograph of the "porch" made by *Anthophora* over the entrance to its tunnel



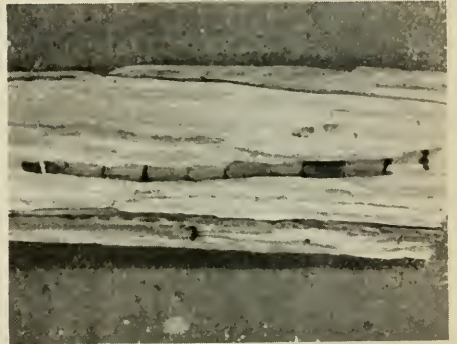
Photograph by Robert Niedrach



Photograph by Robert Niedrach



Photograph by Robert Niedrach



Photograph by Robert Niedrach

The topmost picture (enlarged) shows extremes in the size of bees. The large one is *Mesotrichia tenuiscapa* from Siam, the small one is *Perdita minima* from California. Below the photograph of the two bees, *Diadasia australis* is shown obtaining food from the flower of the prickly pear. Next in line is a photograph of the larva of *Nomia bakeri*, which is to be found in its underground cell

exterminated. Many thousands of species have undoubtedly disappeared altogether, But like the fluctuating changes in climate, these variations, in one direction or the other, do not prevent the existence of a general uniformity over very long periods of time. The line is an undulating one, but not regularly rising or falling.

BEES AND MORNING-GLORIES

One of the most remarkable bees is *Melitoma grisella*, which frequents the flowers of the wild bush morning-glory. This plant is common near Denver, and southward, but we do not get it at Boulder, and hence there is no *Melitoma*. Ordinary long-tongued bees have the mouth-parts so constructed that they can be folded up, and held out of sight under the head. The *Melitoma* has the mouth-parts excessively elongated, and instead of folding up, they are held under the body, like the beak of a plant-bug (Hemiptera). *Melitoma* nests in the same banks as the large *Anthophora* bee, and is related to it in a general way. Each makes a porch at the entrance to the nest, and this structure, made of earth, has a longitudinal slit or opening along its upper side. The porch of the *Melitoma* is attached throughout its length to the bank, but that of the *Anthophora* stands out from the bank, and is regularly curved, with the opening downward. It accordingly has the general form of a water-tap. Comparing the architecture of those various bees, we find that that of the *Anthophora* is most highly developed, standardized and specialized in form. That of the *Melitoma* is more primitive, although the mouth-parts of the *Melitoma* are more specialized than those of the *Anthophora*. The architectural arrangements of the *Nomia* are still more primitive. In the tropics, the stingless honey bees, *Trigona*, construct a funnel or tube of wax leading to the entrance to the nest. This is quite a different structure from any of those made by the native Colorado bees.

The comparisons just made suggest a refer-

ence to the fact that in the course of evolution the various structures or habits do not necessarily become specialized in the same groups. Among the bees, changes may take place in the wings, while the mouth-parts remain relatively primitive, or vice versa. Peculiarities of behavior may arise in one genus, while related genera show nothing unusual. Even closely related forms differ in these respects, and it may be said that every species has some special attributes, not only of form, size or color, but also in relation to its conduct. Facts of this kind have been discussed in the most illuminating way by the French entomologist Fabre. The sexes of bees often differ greatly. In certain of our genera (as *Melissodes* and *Tetralonia*) the males have very long antennae, while the females have them relatively short. The reason for this is not clearly understood, but we know that the antennae are sense organs. In genera related to those just mentioned, the antennae are of the shorter type in both sexes. These same bees usually have the face yellow or white in the male, while that of the female (exclusive of the hair) is black. In the case of *Anthophora*, the light-faced males can be seen guarding the entrance to the burrows, while the females are at work, storing the cells with provisions.

GIANT AND PYGMY

Some bees are very large, fully as large as the last joint of one's thumb. Others are much smaller, and some are excessively minute, so that they cannot be seen properly without a microscope. Among the smaller bees is a genus called *Perdita*, with many species in the Western States. These little creatures, which most people would take for small flies, are associated with particular flowers, from which they rarely stray. The commonest kind may be seen gathering pollen from the so-called bee plant, *Peritoma* or *Cleome*. The collector who wishes to find new and rare bees will look out for different plants, which are likely to have special kinds of bees visiting them.

Where a Comet Struck the Earth

by

Clyde Fisher

Curator, Department of Astronomy
American Museum

Meteor Crater, from which 300,000,000 tons of rock and soil were dislodged some 50,000 years ago, when a gigantic mass of meteoric iron from outer space collided with the earth.

A METEOR shower is one of the most impressive phenomena in the whole realm of nature. Its sudden appearance, together with the suggestion of falling or shooting stars, makes it most effective in exciting wonder and fear, especially in untutored and primitive minds. Various tribes of American Indians used the November shower of 1833, "the rain of stars," as a milestone in their calendars.

While showers or swarms of meteors are comparatively infrequent, the adventitious or occasional meteors are extremely common. It is estimated that between 15,000,000 and 20,000,000 meteors enter the earth's atmosphere every twenty-four hours. According to the counts of Prof. Thomas C. Poulter, of the second Byrd Antarctic expedition, these numbers should be many times greater. Most of these are exceedingly small, weighing perhaps only a few grains each. When we recall that there are 7000 grains in a pound avoirdupois, we realize how tiny they must be. Practically all of the meteors that penetrate the earth's atmosphere day after day are burned up, due to the heat generated by friction in the air, and consequently do not reach the earth.

Occasionally, of course, one comes clear through to the earth, and, if found, it is called arbitrarily a "meteorite," the name "meteor" usually being reserved for one which enters the earth's atmosphere, but which does not come through to the earth. Nearly 1000 falls of meteorites are known, of which 569 are represented in the collections of the American Museum of Natural History.

Although nearly 500 falls of meteorites have actually been observed, the phenomenon still attracts much attention,—and well it might, for these are the only direct messengers from space that come to the earth, the only heavenly bodies besides the earth that we can actually touch. So far as the writer knows, the most recent fall to be observed was that of July 1, 1933, when two masses of stony meteorite were seen to fall near Spartanburg, South Carolina, one weighing about twelve pounds and the other about half as much. This fall occurred in the daytime, and was observed by several persons.

During the last few years it seems that a more than usual number of large meteors, sometimes called fire-balls or bolides, have been observed. On March 24, 1933, a gigantic meteor flashed across five southwestern states. An airmail pilot flying near Amarillo, Texas, declared that it looked as big as the hangar at the Wichita Airport. Some most unusual and striking photographs of the train left by this fire-ball were secured in Colorado. On September 27th last another huge meteor was observed in California by an airplane pilot, who thought it necessary to swerve his plane to keep from colliding with it. In neither of these cases was there found any meteoric material constituting a fall.

The greatest falls of meteoric or cometary material known on the face of the earth were not observed. In fact, with the exception of the Siberian fall of June 30, 1908, all of these occurred in prehistoric times. The first crater produced by the impact of a meteorite or mass of meteorites, that was realized to be such, is Meteor Crater in

Photograph by Clyde Fisher

Right:
Meteor Crater in Arizona,
located about twenty miles
west of Winslow and thirty-
five miles east of Flagstaff,
photographed from a plane
in winter, when snow cover-
ed the landscape, includ-
ing the bottom of the crater



Photograph by Ruth Anna Fisher

Left: Clyde Fisher with Jack Irish, the
pilot on his first flight over Meteor
Crater



Below: Clyde Fisher surveying the Crater
from the north rim. Note the sizable
buildings of the mining company on the
crater floor

Photograph by Te Ata





Photograph from Yerkes Observatory

Craters of the Moon

Above: The moon at gibbous phase between first quarter and full, showing many of the 30,000 craters on the side which is always turned toward the earth. The similarity of these lunar craters to Meteor Crater in Arizona is evident

Below: The elevated rim of Meteor Crater from a distance of two or three miles. It varies in height from 130 to 160 feet

Photograph by Clyde Fisher



Photograph by Clyde Fisher

Right: Meteor Crater, blanketed with snow, as seen from a plane; San Francisco Peaks, from forty to fifty miles distant, are shown in the background; Canyon Diablo, about three miles to the westward, may be seen in the middle ground

Meteor Crater

Below:

Meteor Crater from a plane on an early summer morning. The automobile road connecting U. S. Highway 66 with the north rim shows in the lower right-hand corner

Photograph by Clyde Fisher



Arizona. It was not until the early years of this century that the theory that this crater was caused by the impact of meteoric or cometary material was set forth by Mr. David Moreau Barringer, geologist and mining engineer of Philadelphia, and to him must be given the credit for discovering the origin of Meteor Crater and of convincing scientists of the truth of his theory.

Meteor Crater is best seen from the air, and consequently the most satisfactory photographs have been made from an airplane. A huge, circular crater, nearly a mile in diameter and nearly six hundred feet deep, with a conspicuous elevated rim, formed in solid limestone and sandstone, constitutes an impressive challenge to one's desire to understand the causes of things. Svante Arrhenius, the great Swedish scientist, author of the electrolytic theory of matter, called it "the most interesting spot on earth." This enthusiastic statement was doubtless made in view of his theory for the origin of life upon the earth, namely, that it was brought to this planet upon a meteorite.

Located in north-central Arizona, Coconino County, about twenty miles west of Winslow and thirty-five miles east of Flagstaff, the crater is easily reached by the Santa Fé Railroad or by U. S. Highway 66.

Although doubtless known to the Indians long before, it was first brought to the attention of the scientific world in 1891. It was called at that time Coon Butte or Coon Mountain, the latter part of the name referring to the elevated rim.

WHAT WAS ITS ORIGIN?

The origin of this crater was at first explained by the scientists of the U. S. Geological Survey as the result of a steam explosion. Because of the absence of lava and other evidence of volcanism, no scientists have believed it to be a volcanic crater. One writer advanced the theory that it was a limestone-sink. But the credit for the conception and establishment of the theory that is now well-nigh universally accepted goes to Mr. Barringer,—and a magnificent concep-

tion it was. He set forth the idea that this crater was the result of the impact of a huge, dense mass of iron meteorites, possibly the head of a small comet, and this theory has now come to be held by nearly all geologists and astronomers.

This meteoric mass penetrated 40 to 50 feet of purplish-red sandstone (Moencopie Formation—Triassic), which lies next below the thin soil of the surrounding plain; then crashed through some 300 feet of Kaibab Limestone (Permian Age), the same rock that outcrops in the Grand Canyon of the Colorado in northwestern Arizona, and that caps the eroded pinnacles in Bryce Canyon in Utah; then it plowed into the Coconino Sandstone (Permian Age), which underlies the Kaibab Limestone, shattering this stratum to a depth of some 600 feet, or practically to the Supai Sandstone (Permian) underneath.

IMPACT OF A GIGANTIC METEOR

The meteoric origin of the crater is suggested by the occurrence of literally thousands of pieces of meteoric iron around the crater. These fragments were found as far as four or five miles from the crater on all sides, but the nearer the crater, the more numerous they were. In other words, the Meteor Crater is practically in the exact center of an area from which have been collected many more specimens of meteoric iron than have ever been found on all of the rest of the earth's surface.

The largest piece was reported to weigh nearly a ton; the second largest piece, now in the Field Museum of Natural History, weighs 1013 pounds; a large mass weighing several hundred pounds is in the American Museum of Natural History. It is estimated that between ten and fifteen tons of meteoric iron have been shipped away from Meteor Crater, all of which has been collected within about five miles of the crater, most of it in the immediate vicinity.

Meteorites have been known to burst in the air just before striking the earth, but very few, if any, of the individual pieces of

Meteor Crater iron, whether large or small, show evidence of the bursting in the air of an enormous meteorite. For this reason it is believed that the crater was formed by a huge meteorite accompanied by thousands of small ones, or more probably by a huge dense mass of comparatively small, iron meteorites.

The meteoric iron from the vicinity of Meteor Crater is known as Canyon Diablo iron, named from a gorge located about three miles to the westward.

METEORIC ORIGIN

This Canyon Diablo iron is remarkable in its composition, for it contains from 91 to 92 per cent of iron, some 8 per cent of nickel (common in meteoric iron), traces of cobalt (also common in meteoric iron), silicon, sulphur, phosphorus, carbon, iridium, and platinum, as well as traces of a few other elements. Troilite, a sulphide of iron, found only in meteorites, occurs. Silicon carbide occurs in this iron, and this is the only place it is found in nature. Silicon carbide is manufactured under the trade name of "Carborundum," at Niagara Falls, New York. It is next to diamond in hardness. Probably correlated with the silicon carbide is the occurrence of diamonds, all extremely small. Five diamonds were obtained from this iron by Dr. J. W. Mallet, F.R.S. It was thought that the platinum, along with the nickel, occurring in this meteoric iron would justify a commercial enterprise. In fact, it was this idea that prompted the mining ventures and the explorations which have given us so much interesting information. Considering its composition, it is not surprising to know that the late Dr. George P. Merrill, of the Smithsonian Institution, stated that Canyon Diablo iron is one of the hardest and toughest of all known meteoric irons.

When polished and etched with nitric acid, the Canyon Diablo iron shows definite and pronounced Widmanstätten figures.

Besides the unoxidized meteoric iron, there have been found at the crater many so-

called "shale-balls," which are generally rounded or globular masses of disintegrating meteoric iron and nickel oxide, many of them containing solid nickel-iron centers. The late Prof. O. C. Farrington, who was curator of geology in the Field Museum and certainly one of the greatest students of meteorites, believed the shale-balls to be the result of terrestrial oxidation, and not that occurring when passing through the air.

More than one hundred shale-balls have been found, the heaviest weighing more than forty pounds. Some contain microscopic diamonds. Besides the typical shale-balls there are in and about the crater great quantities of oxidized iron-shale, which without much doubt came from shale-balls. This gives a suggestion as to the fate of some of the Meteor Crater iron. There is reason to believe that most of these irons are residuals of shale-balls.

In determining the origin of the crater, the composition of the elevated rim is significant. This rim, which is 130 to 160 feet higher than the surrounding plain, and one and one-half miles in outside diameter, can easily be seen from more than ten miles away. It is made up largely of boulders and smaller fragments of Kaibab limestone and Coconino sandstone. Some huge boulders were ejected from the crater and thrown over the rim to the distance of a mile or more. It is true, of course, that the ejected boulders occur more abundantly as one approaches the crater.

"STAR DUST"

Much of the Coconino sandstone has been reduced to a fine rock-flour, so fine that it requires a microscope to show that it consists of shattered or pulverized sand-grains. This rock-flour or "star-dust," as it has been called, composes a great part of the rim, nearly three miles in circumference, and it has also been found 850 feet deep in the crater. There are literally millions of tons of fine powder, white as snow. It is estimated that it constitutes 15 to 20 per cent of all material thrown out by the impact.

Of all the evidence that Meteor Crater was caused by impact, perhaps the most convincing to geologists is the fact that much of the Coconino sandstone was changed into a vesicular, metamorphosed rock, looking not unlike pumice stone and very light. In fact, the quartz has been fused, and is now amorphous and not crystalline. This silica-glass or fused quartz has been named by the mineralogists "Le Chatelierite."

The limestone-sink theory could not explain the elevated rim made up of boulders, fragments, and rock-flour. It could not explain the presence of rock-flour and fused quartz at all. It could not explain the presence, in the rim, of Coconino sandstone boulders which came from a stratum that underlies the Kaibab limestone.

A steam blow-out theory might account for the rock-flour, although this seems to the writer extremely doubtful, but it seems certain that no scientist would maintain that it is competent to account for the silica-glass or Le Chatelierite.

Dr. George P. Merrill, internationally known authority on meteorites, states that there is no record of a sudden outburst of volcanic action wherein the heat generated was sufficient to fuse crystalline quartz.

THE STEAM BLOW-OUT THEORY

While the steam blow-out theory is very doubtfully competent to account for the rock-flour or "star-dust," and while it seems certain that it could not possibly account for sufficient heat to produce the fused quartz or silica-glass, it is further weakened by the fact that there are no igneous or eruptive rocks in or around the crater or in the neighborhood, and the fact that there is no evidence of solfataric activity; and by the finding of unaltered sandstone (Supai) in place, in the bottom of the crater in its proper stratigraphical position, shown by the cores of numerous drill-holes sunk in the floor of the crater.

The fact that the crater is in the center of a meteor fall would be looked upon as a coincidence by the advocates of both the lime-

stone-sink theory and the steam blow-out theory. But the finding of meteoric material not only embedded in the talus, underneath the lake deposits in the bottom of the crater, but also 500 to 600 feet below the crater floor, proves that the meteor fall occurred at the same time that the crater was formed. The probability that these two unusual phenomena would occur at the same time and at the same place is so small as to be negligible.

The question that naturally arises is how large a mass of meteoric iron would be necessary to produce the result,—to plow into solid rock and form a crater about four-fifths of a mile in diameter and nearly 600 feet deep!

It has been estimated that the mass of meteoric iron weighed as much as 10,000,000 tons, that it was several hundred feet in diameter, and that it was moving from seven to forty miles a second.

The amount of rock dislodged and partly thrown out of the crater has been estimated at over 300,000,000 tons. The true crater is filled to one half its depth with rock fragments which rolled back.

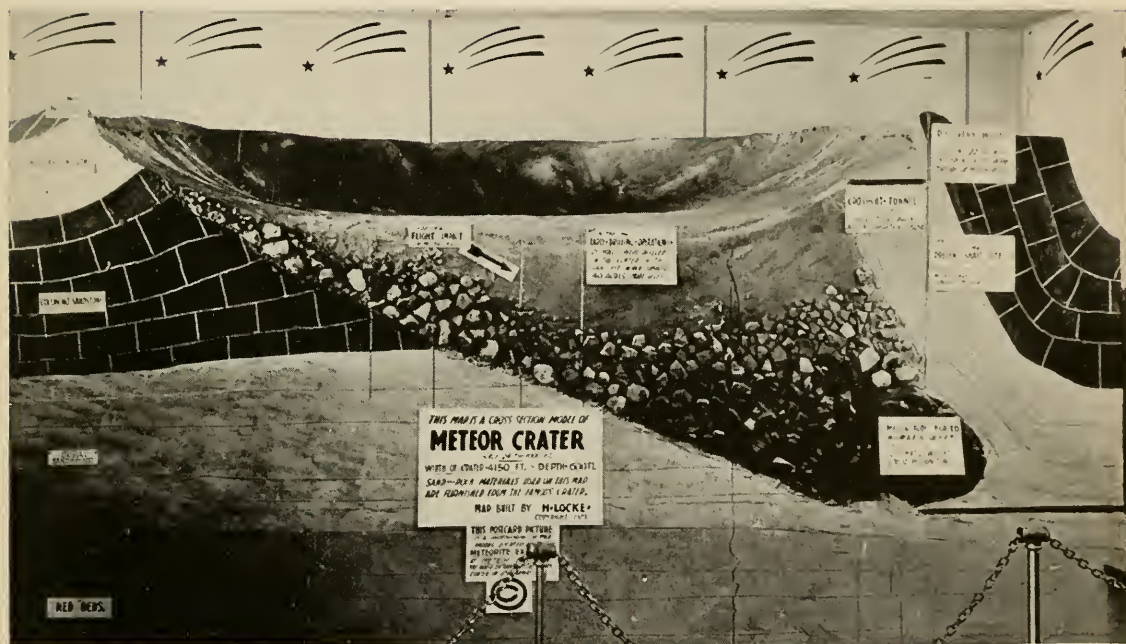
On the bottom of Meteor Crater there are now from 70 to 90 feet of lacustrine or lake sediments formed when this was a small lake. In these deposits many fossil shells were found, which were identified by Dr. W. H. Dall as "all recent species local to the region of southwestern United States."

Prof. Elihu Thomson, after visiting the crater, wrote, "This Arizona crater bears all the evidences of impact and the evidences of nothing else."

If this crater was formed by impact, where is the main mass of the meteoric iron? Mr. Barringer and his associates have attempted to answer this question by drilling some twenty-five holes in the floor of the crater. A number of these have gone down into the undisturbed Supai sandstone, but no large pieces of meteoric material have been found in these borings. Finally a bore-hole some 1400 feet deep was sunk on the south rim, at the bottom of which some hard body was

Photograph by W. T. Gordon

Right: Hoba, the largest known meteorite, near the southern boundary of the Hoba-West farm in the Grootfontein district of Southwest Africa. Estimated weight 60 to 70 tons. The second person from the left is Dr. L. J. Spencer, who has charge of meteorites in the British Museum



© H. Locke



Above: Self-explanatory model of cross section of Meteor Crater built by H. Locke

Left: Canyon Diablo iron, weighing several hundred pounds, now located in front of Fred Harvey Indian Building in Albuquerque, New Mexico

Photograph by Clyde Fisher

struck. Of this boring, Mr. Barringer reported, "Eventually this hole (the last boring sunk through the south rim, it having been determined that the mass approached from the north at an angle of approximately 45°) encountered what is beyond doubt the upper part of the buried cluster of iron meteorites, finding it exactly in the predicted position." No one yet knows how large it is. It is significant however, that the geophysical investigations, both magnetic and electrical, as well as the geological evidence, all pointed to a large mass of meteoric iron under the south rim.

Suggestions have been made that perhaps the main mass of the meteorite is no longer to be found. In this connection Dr. F. R. Moulton, co-author of the Planetesimal Hypothesis, wrote: "If the meteorite entered at a speed of 10 miles per second and only 1 per cent of its kinetic energy were used in expelling it, then it would be thrown out with a speed of one mile per second." He and others have suggested that the energy of on-ward motion, when the meteoric body was suddenly stopped, might have been transformed into sufficient heat to vaporize the main body.

The inevitable question arises: What is the age of Meteor Crater? It is certainly young, geologically speaking. The sharp angles of the boulders and fragments of the rim and talus indicate that. Some juniper trees growing on the south rim are said to put it back

at least 700 years. The presence of lapilli and volcanic ash found in the lake deposits in the bottom of the crater correlate it with the last volcanic eruptions in the near-by mountains of Arizona. These, together with other evidences of the lake deposits, point to a probable age of 50,000 years.

A comparison of Meteor Crater with the craters on the moon has led some scientists to believe that the latter were also caused by impact. While it is probably true that the majority of astronomers accept the volcanic theory of the origin of the moon's craters, there is much evidence in favor of the impact theory.

Until recently it was believed that Meteor Crater was the only one of its kind on the face of the earth, while there are 30,000 on the side of the moon turned toward the earth. But more and more are being identified on the earth. The meteorite craters so far studied are distributed as follows: one near Winslow, Arizona; one near Odessa, Texas; a group of some thirteen near Henbury in Central Australia; the Wabar craters in Arabia; a group of craters on the Baltic island of Oesel belonging to Estonia; the Siberian craters; a doubtful one at Ashanti, in West Africa; a doubtful group near the coast of South Carolina; a supposed crater in Persian Baluchistan; and the Campo del Cielo craters in Argentina. However, judging from descriptions, the most impressive and the most interesting of these is Meteor Crater in Arizona.

*Photograph by
Clyde Fisher*



Huge boulders in the rim thrown up at the time the crater was formed

Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by
A. Katherine Berger

Moose and Wapiti in the Western United States

Doctor H. E. Anthony returned to the American Museum October 22nd from a short expedition to Wyoming and other western states. The primary purpose of his trip was to collect a study specimen of the moose found in Wyoming and named for the Hon. George Shiras, 3d, the Shiras moose. Owing to the generosity of Mr. Shiras, who contributed funds for the collecting of a specimen of this species, Doctor Anthony was able to camp on the upper Yellowstone where moose were plentiful, and to pick a very good bull which was saved as a skin and complete skeleton.

The unusual conditions of drought throughout the West had so dried up the valley of the upper Yellowstone that areas formerly marshy were firm and dry, and there was exceptional opportunity to study moose in the willow thickets and meadows along the river. In a short space of time, from 2:30 P.M. to dark, on the day Doctor Anthony first pitched camp, he saw no fewer than thirty moose of which several were males with large heads. The bulls were trying out their antlers against the brush and occasionally against one another, and several times during the night the clashing of horns, as two bulls tried their strength, awakened sleepers in the camp.

Doctor Anthony also secured a good specimen of bull wapiti for the Museum as well as small series of the smaller mammals from the Snake River valley near Jackson, Wyoming. Doctor Anthony was the guest of Mr. Prentiss N. Gray at his ranch on the Snake River, and due to the coöperation of his host he was able to accomplish much more during his brief trip than would otherwise have been possible. At this time Mr. Gray and Mr. R. R. M. Carpenter were engaged in collecting a group of wapiti for the Philadelphia Academy of Sciences, and Doctor Anthony joined forces with their camping party. Mr. Frederick F. Dalley and his son, of Ancaster, Ontario, were also members of the same party.

Doctor Anthony drove through Yellowstone Park and over some of the wapiti range to the south of the Park in order to secure first-hand impressions of grazing conditions as these animals find them. The status of the Wyoming wapiti is the cause of much concern to all of the conservation societies in this

country. As a member of the committee of several of these societies, he obtained information on this trip which will be of considerable service. Unfortunately for the wapiti, the drought has unquestionably cut down the range along the Wyoming-Idaho border.

Upon completion of the work in Wyoming, Doctor Anthony motored back by way of California, Arizona, and the southern states, to complete a round trip of more than 9000 miles back to the Museum. Throughout most of this circle he was deeply impressed by the serious consequences of the drought, and discovered that in many regions the setback to the flora and fauna has been of such a degree that a number of favorable seasons will be needed before original conditions can be restored.

Eskimo Study

Junius Bird has recently returned from a two months' sojourn in Hopedale, Labrador, where he and Mrs. Bird with one Eskimo were engaged in a search for the oldest Eskimo remains in that vicinity. In the course of their work, twenty-one houses at five different sites were cleared. These houses were originally made of sod with stone paved floors (the winter houses typical throughout the Arctic) and averaged about 40 feet long by 25 feet wide. From the results of the summer's work it appears that the ancestors of the present-day Eskimo have been in Labrador no longer than 400 years, because in most cases, the kitchen middens contained iron nails, etc., of European manufacture.

Flora of New Guinea

The New York Botanical Garden reports that the entire study set of specimens from the Archbold collection of plants from New Guinea has now been mounted. Members of about twenty families are being packed for shipment to specialists in other parts of the United States, in England, Germany, France, Holland, and Sweden. The rest of the determinations will be made at the Botanical Garden.

This valuable collection of flora was made by Mr. L. J. Brass on the Archbold American Museum Expedition to New Guinea in 1933-34.

No More Electric Seals

Responsible furriers have for ten years or more fought the despicable practice of the trade of misrepresenting furs by misleading names so that by a

little dyeing and a little lying the muskrat became a seal, the rabbit a fox. To N. R. A., however, must go the credit of requiring that all furs be truthfully labelled. This year the untutored fur buyer may look for such labels as "domestic dog" instead of "Persian lamb," "Isabella fox" or "Japanese lynx" or raccoon instead of "Alaska sable," with a fair chance of knowing what kind of fur she is getting, if not what quality.

Under the new ruling a dyed, blended, tipped, or pointed fur must be so labelled; the true name of the fur used as the last word of the description. When a geographical name is used, it must be the actual country of origin of the fur, as "Russian house cat," except wherein the country or place indicates a color, in which case this must be indicated, as in "Sitka-dyed fox."

One may presume, however, that a new group of euphonic names will be in vogue. Doubtless the rabbit will remain a "lapin," the woodchuck a "mammoth," the coypu rat a "nutria." The public likes to be fooled.

Wild Life in Uganda

Under the title "Wild Life in Uganda" the *London Times* of August 18 printed the following interesting editorial concerning some results of wild life conservation in Africa.

Recent news from Uganda suggests that in parts of tropical Africa official zeal for the protection of wild life can be carried too far. A generation ago the elephant seemed doomed to extinction in Uganda; an article from our Correspondent which is published on this page suggests that these huge and noble beasts are now becoming too abundant for the comfort of the farmer. The latest annual report of the Game Warden contains excellent evidence—that of an elephant poacher now turned game-ranger—of their increase. In less than thirty years many herds seem to have doubled, and quantity has been accompanied by no deterioration in the quality of their ivory. For some years past the authorities have tried to control their movements. The herds are attacked if they stray out of the uninhabited districts into cultivated country; at one time they seemed to have learned the danger of trespassing, but the statement that the shooting of over 400 of them in one area has had "little effect" seems to indicate that earlier lessons are forgotten when an elephant population becomes too numerous for its habitat. And when the object of its invasion happens to be a banana plantation or a cornfield, a few elephants can ruin a village harvest in a night. Their power of travelling rapidly and noiselessly over long distances makes their attacks the more formidable; they are therefore a constant threat to the cultivator, and if their numbers are allowed to increase as they have done of late the farmer in Uganda is likely to become increasingly critical of their protection by the authorities. No one with any imagination would desire the extermination of these splendid beasts, but their multiplication will have to be drastically checked unless the British and African authorities in the Protectorate are prepared to pay very heavy compensation to the aggrieved peasants. Their tendency to wander and their capacity to live on many different kinds of vegetation, whether in swamps, mountain forests, parklands, or jungles, make control far more difficult than is the case with local species such as the white rhinoceros or the tree-climbing gorillas of Kayonsa. These interesting apes seem to be on nodding terms with the local pygmies, and to be much better tempered than the mountain gorillas of Belgian Ruanda; their small numbers—their community is at most eighty at-ong—and their specialized habits make their protection a much easier matter.

Spiders and Bats

Mr. Wallace Adams, chief of the Fish and Game Administration and Insular Game Warden in the Philippine Islands contributes to *NATURAL HISTORY* the two following unusual observations on the habits of spiders and bats:

A SPIDER GOES FROG-HUNTING

On the evening of October 15, 1931, Dr. Otto Schöbl, the eminent scientist of the Bureau of Science, Manila, Philippine Islands, while sitting on the porch of his house, was startled by the cry of a frog evidently from pain or fright. Thinking it had been caught by a snake, as he had previously seen occur near this same place, he changed his position to make sure and was greatly surprised to see a spider, about two and a half inches long, grasping a frog larger than itself.

The spider was observed to cling to the vines, at the same time holding the frog with some of its legs and the two fangs which were imbedded in the frog, which was going through titanic convulsions. The frog was suspended in a horizontal position.

While under observation the frog stretched out all four legs to their full extent and apparently died. Doctor Schöbl noted that the action of the frog was the same observed when this animal is struck by a cobra, and it was his opinion that the frog died from poison injected by the spider.

This tragedy occurred in the dense vines of the porch into which the spider escaped with its prey. Unfortunately, neither the spider nor the frog was recovered for identification.

FISH TRAP CAPTURES MAMMALS

In examining a small bobo, or fish trap, which hung in the corridor of the Manila Aquarium the remains of four bats were found.

This cylindrical trap, measuring thirteen inches in length and four and one half inches in diameter, has the customary funnel entrance with an outside opening of three and one fourth inches and tapering to an irregular opening of about one half by five-eighths of an inch. This opening is about six inches from the entrance and is formed by the ends of the sharpened bamboo splints or sticks.

The entire trap is constructed of split bamboo very closely woven, and is used by the Ilocaños of the Ilocos region of Luzon for the catching of *Ipon* or small gobies.

The remains are those of adult bats, three having been caught apparently at one time while the other evidently entered at a later date. The well-known habit of bats to secrete themselves in dark places led these four to their death.

The Aquarium is an open structure so that bats have free access at night, as they do in most of the buildings in and about Manila, and it is not unusual to see them cross and recross the area lighted by the projector in the theaters.

Shrunkened Heads

Two shrunkened heads from the interior of Ecuador were recently presented to the American Museum by Mr. and Mrs. E. Hope Norton. While other shrunkened heads are already in the Museum, these are

exceptional because of their specially made headdresses. Each headdress has a long coil of beetle wings over a base of human hair. Beetle heads are used as a border across the forehead, and red and yellow bird feathers complete the headdress. The Jivaro Indians give this treatment to the heads of their slain enemies, which they keep as trophies of war. While the process of head-shrinking varies slightly, these heads are typical of the general manner in which it is done. Both heads were slit from the top center to the base of the back of the neck in order to remove the bone, then carefully sewn. Hot sand was then poured inside to shrink the head, while the outer skin was ironed with a heated stone. During the shrinking the face is constantly modeled with the fingers in order to keep the resemblance of the dead enemy. The headdresses described above were then made to fit the heads.

These two heads are notable additions to the South American Hall collection at the American Museum.

Foreign Museums Honor Professor Osborn

During the month of August and early September Professor Osborn motored in his own car 2170 miles through western Germany, Austria, and northern Italy, from Hamburg to Genoa. En route he visited the museums of Stuttgart, Tübingen, Jena, and Munich, especially the Deutsches Museum founded by his friend, the late Dr. Oskar von Müller. When Doctor Müller left America after an incognito visit to the American Museum, he stated in a newspaper interview that the two things which impressed him most were Niagara Falls and the American Museum of Natural History; Professor Osborn returns the compliment by saying that the Deutsches Museum in its educational arrangement far surpasses any museum in the world today. It embraces history and evolution of not only every branch of science—chemistry, physics, astronomy—but also of all the applications of science up to the latest discoveries; it also covers the history of musical instruments, especially those developed through the genius of Germany.

Professor Osborn was given a warm reception in Frankfurt by Dr. Arthur von Weinberg, honorary president of the Senckenberg Museum, also by Dr. Rudolph Richter, who has succeeded Director



SHRUNKEN HEADS FROM THE INTERIOR OF ECUADOR

Drevermann. He was invited to address the Johann Wolfgang Goethe University and officers of the Museum in special convocation August 22. As he was obliged to resume his journey earlier, the special convocation was held on August 20, when the honorary degree of Doctor of Science was conferred upon him in the presence of the science faculty and the museum staff.

At Tübingen Professor Osborn was most cordially received by Dr. von Huene, distinguished head of the University Museum, under whose guidance he studied the superb collections assembled by Dr. von Huene, including the theriodonts of Brazil and South Africa, and especially the room of honor for the skeletons of *Plateosaurus*. He also saw the fine collection of Aurignacian carvings collected by Dr. Gustave Reich, recently discovered in the caverns, including earliest examples of prehistoric sculpture of the horse, mammoth, and lion—a fine phase of glyptic art.

At Munich Professor Osborn was cordially guided by Dr. Stromer through the rearranged collections of the Museum; also by Dr. Ferdinand Broili, director of the Staatssammlung.

An Appreciation of Dr. Berthold Laufer

Berthold Laufer, curator of anthropology, Field Museum of Natural History, Chicago, died September 13, 1934.

Doctor Laufer was born in Cologne, Germany, October 11, 1874. He received his previous training in the Universities of Berlin and Leipzig, receiving his Ph.D. degree from the latter in 1897. He began his anthropological career in America as a member of the Jesup North Pacific Expedition organized by the American Museum and directed by its department of anthropology, spending a year (1898-9) in anthropological research on the Island of Saghalin and among the natives of the Amur River in Eastern Siberia. The collections made at that time are now on exhibition in this museum, and the results were published in the *Memoirs* of the Jesup North Pacific Expedition.

In the meantime, the department of anthropology developed a project for collection and study in China, financed by the late Jacob H. Schiff. Doctor Laufer was then appointed a special investigator under this grant and spent the years 1901-4 in China, collecting materials and information for an exhaustive study of the original culture of the Chinese. These collections are now on exhibition in the Asiatic Hall of the American Museum.

Shortly after Doctor Laufer's return to the Mu-

seum, he accepted a position in the Field Museum of Natural History, Chicago, where he eventually became head of the department of anthropology. He was the outstanding authority on the peoples of Eastern Asia, and contributed many important publications in this field. His untimely death is a great loss to American scholarship.

Distinguished Guests

Prof. Henry Balfour, director of the Pitt-Rivers Anthropological Museum at Oxford University was a visitor to the American Museum late in September. He was especially interested in the Mongolian material in the Museum's collections.

Astronomy

The construction of the Planetarium building in the northeast corner of the American Museum grounds is progressing very rapidly. The steel work and floors have been finished and the ribbing forms are practically ready for the pouring of the concrete for the exterior dome. To see the building taking form is most encouraging and points to the opening not many months hence. At the request of the R.F.C., motion pictures are being made every few days, showing the progress of development.

An Omission

Dr. Clyde Fisher's name was inadvertently omitted from the review of *An Astronomer's Life*, by Edwin Brant Frost, which Doctor Fisher had contributed to the Book Review Department of NATURAL HISTORY for November.

Recently Elected Members of the American Museum

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Patrons

Mrs. CLIFFORD H. POPE.
Mr. MICHAEL LERNER.

Honorary Life Member

Mrs. ROSANNA D. SANDERSON.

Life Member

Mrs. GEORGE SHIRAS, 3d.

Sustaining Member

Mrs. LLOYD SALTUS.

Annual Members

Messdames LEAH HABER, DOROTHY S. HORWATH, LAURENCE ROSSBACH, JOSEPH B. SCHUSSER, J. SHEDD, H. S. STERLINGO.

Mother ST. PAUL.

Sisters MARY ANITA, M. FELICITAS.

Misses MABEL M. BORCK, GERTRUDE I. BYRES, FILOMENA M. GRECO, MILDRED C. McAUSLAND, ELVIA R. MIRAGLIA, ALICE H. RALSTON, GRACE RANDALL, MARY ELIZA SAUNDERS.

Doctor ALFRED MEYER.

Messrs. LOUIS K. BERMAN, GODFREY BLIGH, W. O. BORCHERDT, HERMAN C. KOENIG, MAX ROSETT, HEINZ RUCHE, LAWSON SANDFORD, SIG. SAXE, WILLIAM B. SCHALLEK, F. H. SCHAUFELER, FREDERICK A. SPENCER, WILLIAM D. VOORHEES, JR., HILLIARD WOLFSON, E. G. WOODWORTH.

Associate Members

Messdames BRUCE BROOKS, CHARLOTTE CARROLL, TRUMAN PARKER HANDY, AUSTIN IGLEHEART, DUNCAN MCLAURIN, F. I. W. ROBINSON, H. R. ROBINSON, I. J. ROE, SAMUEL RUSSELL, WALTER J. RYAN, E. L. RYDER, HOWARD F. SHATTUCK,

DOROTHY H. SIELKE, WARREN VAN KLEECK, MARGARET E. VAN WINKLE, A. E. WILLIAMS.

Sister MIRIAM URSULA.

Misses EUNICE FOSTER, FLORENCE S. HAMMOND, MARTHA HEAGY, NELL HIRSCHBERG, EFFIE B. INMAN, FRANCES M. KEWISH, PAULA LIND, NAOMI R. LUKER, MARGARET G. MILLER, MARY L. G. MUIR, BESSIE M. ROSS, HANNAH HARRIET SAM, MAGDALENE SCHLUENZEN, CHARLOTTE SCHNEE, HARRIET SEARIGHT, JENNIE D. SHERWOOD, MILDRED C. SWEET, MARGARET TAPPEN, ALICE W. TUCKER, ARLENE J. VAN DERHOEF.

Reverend THOMAS B. McCLEMENT.

Colonel FRANK JAMES MORROW.

Major ROBERT E. CHEESEMAN.

Doctors H. S. BALDWIN, M. BECKETT HOWORTH, CLARENCE A. MILLS, PHILIP ROSENBLUM, EDNA M. ROUND, LESTER A. ROUND, SAUL S. SAMUELS, JEROME SELINGER, W. B. SHORT.

Professors S. C. SCHMUCKER, RUSSELL G. SHOLES.

Honorable JOHN J. FRESCHI.

Messrs. LAFONE R. BELLHOUSE, WILLIAM W. BENT, RICHARD H. BILLS, GEORGE H. BISSINGER, B. F. BLACK, ARTHUR BOLTON, F. BOERLIERE, CARL BURGER, HENRY R. CHADSEY, SOL CHAWKIN, ISAAC CHERKASSKY, DERICK DANIELS, SAMUEL DANIELS, HAROLD DIXON, LOUIS DREZNER, BRENT R. FINCH, HERBERT GOLDSTEIN, GILBERT A. HARRINGTON, NAONOSUKE HAZAMA, H. HERTZFELD, MURRAY T. JOHNSON, JOHN ANDERSON JOHNSTON, FREDERICK B. KOPF, MICHAEL LEDER, JOSEPH V. MITCHELL, DOUGLASS CECIL NORTH, HENRY I. PATRIE, SAYRE SPRING PHILLIPS, JOHN PRICE, R. E. ROBERTSON, ALEXANDER, C. ROBINSON, GEORGE B. ROSE, RALPH N. ROSENBAUM, GILBERT ROSENBERG, ARTHUR P. ROSS, L. S. ROSS, BERNARD A. ROTHMAN, CHARLES J. ROYLE, I. J. RUBIN, GUSTAVE RURNER, ADOLPH A. RYDGREN, J. L. SAVAGE, G. A. SCHIEREN, JR., AARON SCHOEN, AARON SCHREIMAN, RAYMOND C. R. SCHULZE, F. J. SCUDDER, J. H. SENIOR, F. DICKEMAN SEYMOUR, J. A. SIMPSON, P. T. STALL, WILLIAM S. WARREN, WILLIAM F. WEISS, ALFRED F. WHITING.

Reviews of New Books

Paleolithic Man and the Nile Valley in Nubia and Upper Egypt. By K. S. Sandford and W. J. Arkell, Univ. of Chicago Press, 1933. Quarto, 92 pp., 21 text figs., 43 plates, map.

THIS more than ordinarily interesting publication, issued by the Oriental Institute of the University of Chicago under the editorship of its director, James Henry Breasted, was presented to the Osborn Library several weeks ago. Considered in its full setting, it is the second volume of a report on the archæo-geological investigations conducted by the authors in the Nile Valley region during a period of years beginning in 1926. The specific aim of the protracted field observations is the determination of the geologic antiquity of man as revealed by his chipped stone implements found imbedded in the fluvial deposits constituting the Nile Valley floor and side slopes for a distance of several hundred miles upstream. A typical cross section of the valley trough is marked, especially on the west side, by a series of steps or terraces composed of gravels laid down at successive stages in the descent of the river level. There are at least seven of these gravel terraces, respectively at 300, 200, 150, 100, 50, 30, and 10 feet, above the present valley floor, the top terrace being necessarily the oldest. Subsequently, the valley floor and even the lower gravel terraces were overlaid by a deposit of fine silt, presumably due to a temporarily high, slow-moving Nile current. Since the final drop in the river level, the silts on the valley slopes have been largely removed by erosion, while, in the case of the valley floor, deposition still goes on from year to year.

To date no unquestionable artifacts have been found in the three upper gravel terraces, said to be of either Late Pliocene or Early Pleistocene age. The first recognizable implements, of Chellean type, occur in the 100-foot terrace, which is regarded as definitely Pleistocene. The succeeding terraces contain implements respectively of Acheulian, Early Mousterian, and Middle or full Mousterian affinities. The mantling valley slope silts contain a flint inventory beginning as Late Mousterian in character and ending as a microlithic industry resembling the Azilian-Tardenoisian of Europe. This silt phase industry, called Sebilian after the type site Sebil, corresponds in time and in general typological characteristics to the Upper Paleolithic of Europe. The succeeding Neolithic and Dynastic remains are found on the surface of the ground, as well as in the more recent silts composing the valley floor, and therefore involve no important geologic considerations. All in all the report is a masterly piece of work, yielding results of the highest significance for archæology.

—N. C. N.

Recent Publications For Those Interested in Nature

"The Natural History of the Frilled Shark, *Chlamydoselachus anguineus*." By Eugene W. Gudger and Bertram G. Smith. Article V of *The Dean Memorial Volume: Archaic Fishes*, 1933, 245-319, fig. 1-31, Pl. 1-5.

READERS of NATURAL HISTORY will doubtless recall that the late Dr. Bashford Dean, founder of the American Museum's department of fishes, and curator of arms and armor at the Metropolitan Museum of Art, left behind him a double legacy and tradition, on the one hand to zoölogy and on the other to art and history. Under the first heading were his own numerous investigations on archaic fishes, including the old armored fishes of Palæozoic times and their more or less degenerate descendants, the lampreys, sharks, and ganoids of the present time; his legacy to art and history on the other hand was the result of his amazingly fruitful labors in the field of arms and armor. Moreover, Dean inspired many of his old students and colleagues to carry on his work along various lines after his death, and it is they who have initiated and are either continuing or have already completed the *Dean Memorial Volumes*. These include the recently published imposing "Catalogue of the Dean Collection of Arms and Armor in the Metropolitan Museum," put forth by his friends of the Arms and Armour Club, and the *Dean Memorial Volume on "Archaic Fishes,"* which is being issued in parts by the American Museum and will eventually form a completed volume.

The purpose of this volume, which is being edited by Dr. E. W. Gudger, is to present original contributions to the study of the "archaic fishes"; it is based in part upon the material collected by Dean himself, and illustrated mostly by his own hand in a superb series of previously unpublished plates, picturing many stages in the embryology of the hagfish (*Bdellostoma stouti*), the frilled shark (*Chlamydoselachus anguineus*), and the Port Jackson shark (*Cestracion philippi*).

The latest memoir of the series, by E. W. Gudger and Bertram G. Smith, deals with the natural history of the frilled shark. This extraordinary creature once made a great stir among zoölogists and palæontologists by getting itself discovered at a propitious period in late Victorian times, long before swarms of fruit flies, rats, and guinea pigs had crowded other animals out of most zoölogists'



THE OPEN MOUTH OF *Chlamydoselachus anguineus*, SHOWING THE TRIDENT-LIKE TEETH SET IN ROWS. PHOTOGRAPH OF A HEAD PRESENTED TO THE ZOOLOGICAL CABINET OF COLUMBIA UNIVERSITY BY DR. BASHFORD DEAN ABOUT 1905

laboratories. The frilled shark, which is found chiefly in fairly deep waters off the coast of Japan, has the piratical look of a large eel (whence its specific name *anguineus*) and its huge mouth bristles with an armature of trident-like teeth, with points sharp as needles.

These three-pointed teeth led to a controversy between Samuel Garman of the Museum of Comparative Zoology of Harvard University and the describer of the frilled shark, and Prof. E. D. Cope, the famous palæontologist and zoölogist, of Philadelphia. Dr. Thomas Barbour, the present director of Garman's old Museum, tells us that Garman, who was a most painstakingly accurate, conservative, and conscientious worker, undeniably disliked Cope, with his slapdash inaccurate citations and half-baked generalizations. Cope, from a hasty reading of Garman's preliminary descriptions, immediately rushed off a note to the *American Naturalist* proclaiming the frilled shark as a living survivor of the fossil sharks of the Permian Age, represented by *Didymodus*. Garman replied in substance that in the frilled shark the teeth were trident-like, while in the Permian *Didymodus*, each tooth had but two main cusps. Cope, ignoring the correction, stuck to his guns and made more inaccurate statements, giving wide circulation to what might well have been called the "myth of the frilled shark." Then Garman, doubtless praising the Lord who had delivered his enemy into his hands, came down hard on

Cope, showing him up at every point and eventually forcing a somewhat half-hearted apology from him. Nevertheless, Cope, though wrong in detail, was generally adjudged by zoölogists to be right in principle, and Dean himself believed that *Chlamydoselachus*, although specialized in some features, was truly an archaic survivor of the sharks of far-off Palæozoic times. Not even the authors of the present work, however, have ventured to "debunk" this venerable figure, beyond noting the fact that the family to which it belongs is not known through fossils of earlier than Pliocene date. And it might well have been pointed out that all the really primitive known sharks of Palæozoic age differ widely from the frilled shark in skeleton, in dentition, and in pattern of the shagreen denticles with which the skin is studded, thus increasing the probability that the frilled shark is a relatively modern type.

However, this rather irreverent comment upon what is only a small section of the excellent memoir by Gudger and Smith is really inspired by a letter from Doctor Barbour, recently published in *Copeia*, from which we venture to quote the following sentences:

All of this . . . is written for just one reason and that is to explain why, when I got Gudger and Smith's great memoir, I read it avidly from cover to cover. Here is the true story of this splendid and extraordinary creature, the whole story so far as that can be written today. Here is not only a complete, painstaking search for every atom of available information, but a fair and generous presentation of the controversies to which various appraisals of its relationships both with recent and fossil sharks, have given rise.

The whole material is well written, the illustrations are admirably chosen, the presentation is clear and fair—what more can one ask for. Ichthyologists owe the authors a debt of gratitude. They hope for more. How Garman would have devoured this great paper had he lived to see it appear!

The "more" referred to by Doctor Barbour will, it is planned, be forthcoming in due time, in a paper by Prof. Bertram G. Smith on the anatomy of the frilled shark.—W. K. G.

To The North. By Jeanette Mirsky. The Viking Press, 1934.

JEANETTE MIRSKY's book tells the story, embracing many centuries, of man's conquest of the Arctic. More than merely a history of the northward expansion of the geographical horizon, *To the North* presents the epic of man's strenuous efforts to triumph over an Adversary (for as such it has been the habit to personify the Arctic until recent times), and to solve the mysteries of a long forbidden realm. In that the mysteries have mostly been solved, it is a story of the broadening of the mental horizon. The lasting drama of the tale, however, lies in the feat of mastering the mysteries in such a way as to render the "adversary" permanently less formidable.

Attempts to explore and colonize the primitive North are by no means a recent form of enterprise.

Jeanette Mirsky's book tells how before 1000 A.D. the Norsemen established a settlement in Greenland which quickly grew to 2000 persons and for three centuries flourished, then suffered complete extermination by causes unknown. She describes also the life of a Seventeenth Century boom town of 15,000 north of Spitzbergen, within eleven degrees of the Pole, which endured less than half a century.

Purely exploratory expeditions have left a similarly dismaying trail of death. At least four such expeditions described in *To the North* perished *in toto*; and no less than eight others lost at least a third of their members.

The rule, which applies in exploration as well as in warfare, that the successful invasion of a territory depends largely upon the correct understanding of the opponent's weapons, has proved a tragically difficult lesson in the Arctic. Someone has remarked that it took civilized man six centuries simply to devise a shirt that conveniently buttoned down the front. With perhaps graver implication it might be pointed out here that it took white man in the Arctic about as long, even though his motive in going there was often to secure furs for sale in more temperate regions, to learn the wisdom of wearing proper furs himself. This is one illustration out of many. Six centuries and longer to learn how to live and travel in the North! And the irony of it is that the Eskimos and other Arctic peoples knew how all along.

Jeanette Mirsky's book carries us down through the work of the modern explorers, who only recently have succeeded in rendering the Arctic permanently less formidable. The triumph of Peary through the utilization of Eskimo helpers, and the achievements of Stefansson, who so thoroughly mastered the technique of Arctic travel as to rival the natives themselves, are of course no less glorious for having followed that long era of "victorious defeats." Their work, and that of others after their example, forms the indispensable basis for the latest phase in Arctic exploration wherein aircraft figure prominently.

The discovery of the Arctic makes a dramatic story throughout, and Jeanette Mirsky has displayed a thorough grasp of her subject in recording it.

—EDWARD MOFFAT WEYER, JR.

The Families and Genera of North American Diptera.
By C. H. Curran.

MIDGES, gnats, punkies, mosquitoes and green-heads, to cite only a few of the common names applied to groups of true flies or two-winged insects, are dealt with in a comprehensive work entitled *The Families and Genera of North American Diptera*, by Dr. C. H. Curran of the department of insect life, American Museum. While this work is intended primarily as a reference book, the scientific terminology is as simple as is consistent with accuracy, and the terms used in this and other works on the

subject are explained in an illustrated glossary comprising fourteen pages.

The rôle of flies in the spread of disease and in relation to human welfare is discussed briefly in a clear, convincing manner, under the various families to which the carriers belong, while many of the species injuring crops are also mentioned. According to the author, most flies are beneficial and play an important part in the control of other insects as well as in the pollination of flowers.

In addition to a fine colored plate there are more than 150 pages of illustrations showing the structural details of most of the 1900 genera recognized from North America, including Central America and the West Indies. The profusion of illustrations should prove of the greatest assistance in the use of the keys which comprise the main body of the work.

A book of this kind has long been needed and the author is to be congratulated on the successful completion of so arduous a task.—F. E. LUTZ.

The Handbook of the Heavens. 1934. Published by The Junior Astronomy Club, American Museum.

WITH the exception of the British Astronomical Association Handbook I know of no other handbook for observers, written in the English language, that gives such a concise statement of important celestial phenomena for the year.

The *Handbook of the Heavens* bears all the earmarks of having been prepared by a group of people who know very well just what such a book should contain to be of use to the observer, and the material has been prepared in a form that leaves nothing to be desired.

This *Handbook* should be of use not only to the members of the Junior Astronomy Club and their young friends, but should also be a welcome addition to the outfit of a great many other observers and of many students that take up astronomy in college. I hope that it may be a regular addition to the library of guides for the amateur astronomer.—BART J. BOK.

Memoirs of a Camp Follower. By Philip Gosse. Longmans, Green and Company. 300 pp., 1934.

PHILIP GOSSE went to France as an officer of the R.A.M.C. Few men went into the war and emerged from it to write books on their lives without writing about blood, but unlike other medical officers, Gosse carried with him to the trenches not only his operating tools, but field glasses for birds, traps for mice, and a fishing rod for leisure. The mouse traps were not for the protection of food or bandages, but a means of enriching the collections of the British Museum. Oldfield Thomas, genius for making collectors of naturalists, even had a representative following the King's armies in Flanders.

No matter what the surroundings of a man, if he carries with him a bag of mouse traps, his unsavory reputation spreads, and so it was with Gosse, who found himself one day officially appointed "Rat

Officer to the Second Army." As such he spread the doctrine of rat control until the army was rat-conscious, upon which he was transferred to India. There, the lack of great military activity left him with few official duties, to the benefit of science, for more collections were made and new species discovered in the fauna of India.

Gosse is as admirable a naturalist as he is an author. In France he crept "about the wet ditches and hedgerows with a piece of ration cheese for bait," until the hunter became the hunted, and his actions, suspicious and unbecoming a British officer, caused his detention. In India, where over-ardent work in collecting led to hospitalization, Gosse kept his orderly busily trapping, bringing specimens to the hospital for measuring—until one day the matron changed her lunch hour and objected to a pile of bats, rats, shrews, and a mangy toddy cat on the clean floor of the ward.

The author's enthusiasm, adventures, and good humor will appeal to any reader, whether or not he knows a wag-tail from a kestrel. This author of an exciting book on piracy has shown that the trapping of mice can be attended with adventures as fascinating as the trapping of Spanish galleons.—R. T. HARR.

A Conquest of Tibet. By Sven Hedin. Translated from the Swedish by Julius Lincoln and published by E. P. Dutton and Co., Inc., New York, 1934.

SVEN HEDIN, after half a century of exploration in central Asia resulting in numerous publications both scientific and popular, has become our modern Marco Polo. Though he is still in the field at the age of sixty-nine, the present volume is neither a journal of recent exploration nor a summary of scientific achievements, but is rather a handsomely gotten up book of reminiscences about his repeated adventures in Tibet during the interval from 1896 to 1908. Indeed, the principal interest attaching to the volume is a series of some 250 realistic pen-and-ink sketches by the author largely illustrative of the succession of isolated dramatic episodes composing the verbal account, itself derived presumably from journals elsewhere published in full. For all that, the leisurely armchair traveler may gain from these pages an essentially correct and indelible impression of the long mysterious Tibetan plateau and its people.

More specifically, the book relates some of the events connected with the author's luckless attempt to reach the capital city of Lhasa in disguise. It hints at the more prosaic labors of gathering data for mapping several blank Tibetan areas. And it reveals the author's sense of triumph on locating the sources of the Indus, the Sutlej, and the Brahmaputra rivers, the identification of the Transhimalayan range, as well as his satisfaction in winning the friendship of the then powerful spiritual head of Lamaism, the Grand Lama of Tashi-lumpo. But overshadowing all such details, the really lasting impression conveyed is of a long, long trail, made

difficult at every turn, not only by bandits but by Tibetan officialdom—neither seemingly quite so fierce as might be supposed; a trail winding up and down innumerable cold and ever stormy mountain passes, ranging in altitude around 18,000 feet; a trail strewn with dead and dying pack animals, and even occasionally marked by the graves of faithful native caravan helpers. Touching directly on all this, the one thing which the book does not clearly bring out is the astonishing fact that a lifetime of dangers and hardships such as here described has left no noticeable marks on the explorer himself, who remains ever the same youthful, vigorous, and self assured personality. The book, incidentally, lacks a much needed map of some sort.—N. C. N.

The Secret Kingdom. An Afghan Journey. By Ben James. Reynal and Hitchcock, Inc., New York, 1934.

IN this book, Ben James takes his readers beyond that inhospitable sign, which greets all travellers at the Afghan border, "It is Positively Forbidden to Enter Afghan Territory."

Pleasantly, amusingly, he leads one as by the hand, through trails and villages and towns in that farland, which to most is just a name. If here and there hatred and bloodshed mar the scene, is this not Afghanistan? But there is human interest and comedy to offset the gore.

In the pages devoted to Mr. James's stay in Kabul, one gets a much clearer picture of poor, weak Amanullah's rise and fall, and the succeeding reign of the unlettered bandit, Bacha Saquo, is diverting in the extreme.

The Secret Kingdom is not a scientific work. It is a near approach to a friendly talk with Mr. James himself, a tale, simply told, of experiences such as most of us would like to have.—FLORENCE MORDEN.

Webster's New International Dictionary. Published by G. & C. Merriam Company, Springfield, Mass. 1934

THE second revised edition of *Webster's New International Dictionary* came off the press in August. The following members of the scientific staff of the American Museum served on the staff of its special editors: Dr. Clark Wissler, for anthropology; Mr. Herbert P. Whitlock, for mineralogy; Dr. E. W. Gudger, for ichthyology. Illustrations of mammals, birds, fishes, insects, crustaceans, and other invertebrates, hundreds in number, were drawn by Mr. W. H. Southwick.

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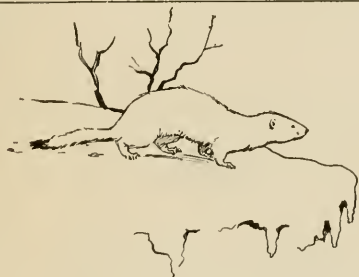
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